the OIL AND GAS JOURNAL
PUBLISHED WEEKLY MAY 29, 1961

Idle rigs pose a problem:

Can drilling-crew quality be maintained? ▸ 99

"Ancient" fields still adding to reserves ▸ 101

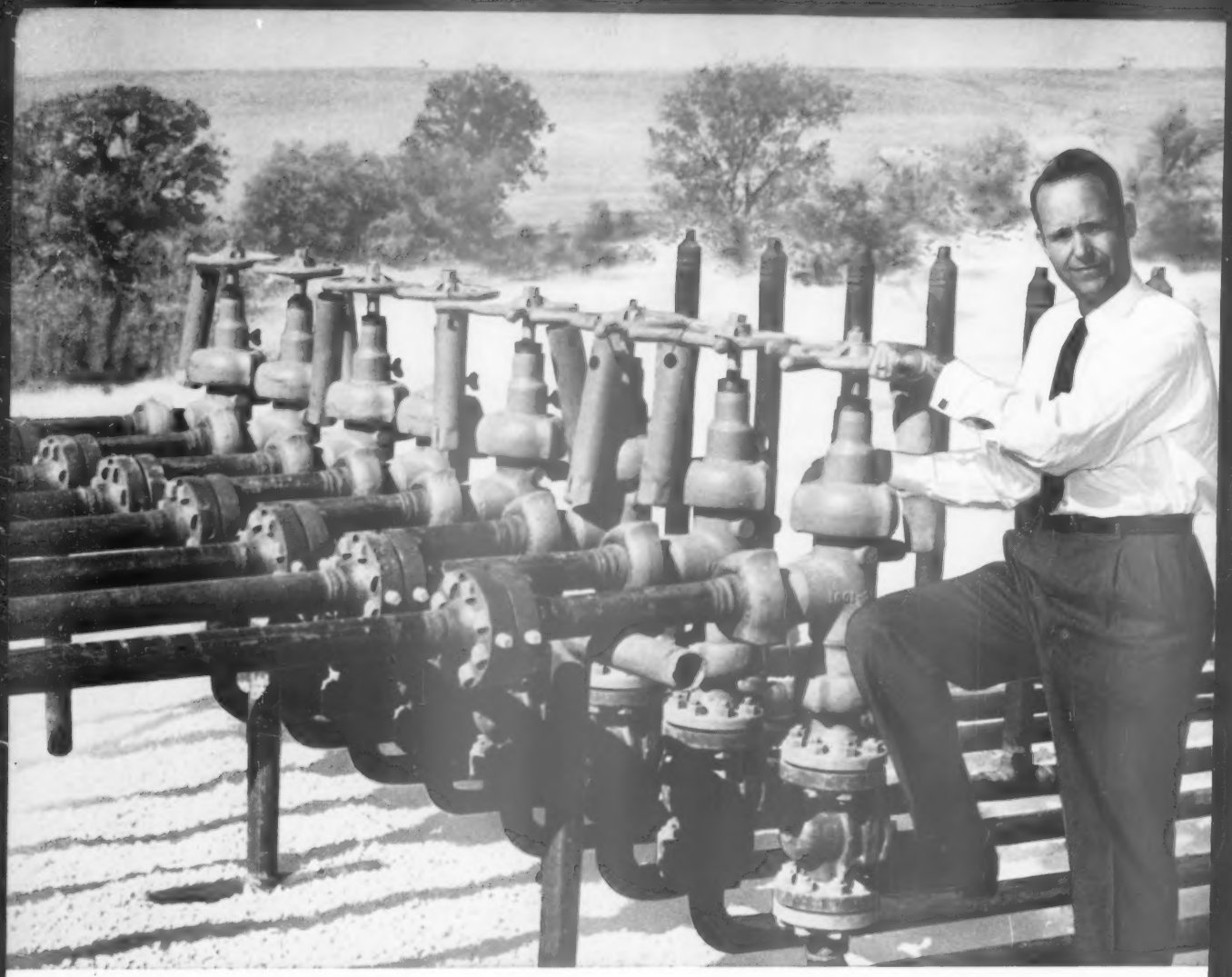
Sell your fringe benefits ▸ 163

Panhandle gas hunt sets hot pace ▸ 210

5-PART Section on

CHEMICAL CLEANING

of processing equipment p. 125

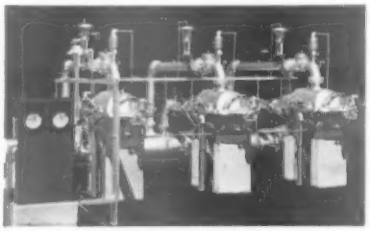


# How an Oklahoma Operator Dried Up Valve Trouble On a Big Waterflood

This is a view of the water injection manifold on the Naval Reserve Field waterflood project in Oklahoma. In the beginning, this operation was plagued with valve troubles . . . until UNIBOLT Adjustable Valves were installed.

As is the case in many waterflood operations, the raw water at Naval Reserve is corrosive and abrasive. Cavitation of the fluid as it passes thru the valve has an eroding effect on the valve seats. However, since the UNIBOLT Adjustable Valve employs both the right design and the right materials, it has practically put an end to this Operator's valve troubles. For example, the stem and seat are of special analysis chrome steel, honed to mirror smoothness. And the stem is guided to the seat thru an extra long pilot that exactly centers it to insure a streamlined flow. Manufacturing details, perhaps, but added to dozens of similar features they add up to perfection and the one valve that is best suited for waterflood injection manifold and similar troublesome services.

Planning a waterflood or having valve troubles in your present system? Talk to the UNIBOLT representative in your area and get all the facts about this Adjustable Valve.



*Three self-cleaning Jet Filters, manufactured by Thornhill-Craver Co., on a waterflood operation near Odessa, Texas. These Filters automatically clean raw injection water to any desired degree, even to sub-micron particle size.*

**THORNHILL CRAVER CO.**

**P. O. Box 1184, Houston, Texas**

OIL AND GAS JOURNAL
Vol. 59, No. 22

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# TECHNOLOGY—OPERATION

## Refining-Processing


SPECIAL SECTION: Chemically Cleaning Process Equipment .... **125**

*By H. C. Bozeman and Paul A. Finn*

In-place chemical cleaning, the act of contacting fouling deposits with effective chemical solutions, is attractive for process equipment, both on the process side and on the service side. The deposits are safely freed and flushed out. This technique reduces down time, lengthens on-stream time, and cuts costs. Keys to successful chemical cleaning are: (1) planning and (2) field control.

New Plastic Combats Tank-Bottom Corrosion ..... **151**

*By D. H. Stormont*

New isopolyester resins have cut maintenance costs, particularly in storage-tank bottoms, during extensive trial application. Some of the repaired equipment is in perfect shape after 2½ years of service.

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## Drilling-Production


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*By Preston L. Moore*

How pipe and hole size affect drilling hydraulics.

How We are Fighting Salt-Water Corrosion ..... **146**

*By H. D. Holloway and T. W. McSpadden*

Use of coated or nonmetallic equipment is the most popular way of combating corrosion. But coating application requires good workmanship to avoid holidays. Corrosion problems will increase in the future with more severe oil-recovery methods.

Low-Water-Loss Cements Improve Formation Cement Squeezes .. **155**

*By H. J. Beach, T. B. O'Brien, and W. C. Goins, Jr.*

Gulf Oil's success in cement squeeze jobs in one typical area was increased from 60 to 85% with the use of low-water-loss cement. And big savings have been made by conducting the jobs so that cement need not be drilled out later.


## Pipelining


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Sell Your Fringe Benefits ..... **163**

*By Robert W. Haacker*

Talk them up. Their real value depends on employe awareness of them.

THE OIL AND GAS JOURNAL **Newsletter**

May 29, 1961

Drilling contractors are beginning to have trouble **hiring competent labor.**

**Big concern:** If the upturn ever does occur for drilling, an acute shortage of efficient manpower will hamstring operations.

**Chief cause** for the drift of workers away from the derrick into other industries is lack of steady work, comparatively low wages, and tough working conditions. Contractors say they can do little to remedy the situation because of their own tight economic position.

**Ultimate trend** may be higher rates for drilling or the operating companies will have to start drilling their own wells (p. 99).

Number of **rotary rigs operating in U. S.** has **topped 1,800** for first time this year.

Hughes Tool report for week of May 22 shows 1,803 rigs working.

Weekly total got past 1,800 only 16 times last year. Seven of these good weeks came in closing months.

Look for **spurt in Lake Erie drilling** off Ontario this summer.

Operators plan to drill 50 offshore wells.

Accent's shifting from west end of lake to eastern portion. Forty-two of new wells will be drilled in east.

▼ ▼ ▼

Watch for mounting interest in **underground gas storage** in Pacific Northwest.

There are no projects in area at the moment. But storage leases were signed recently on 5,000 acres near Mary's Corner in Lewis County, Washington.

Reports say Pleasant Valley Oil & Gas Co. holds option on block centered in T12n-R1w and plans to complete gas-storage project by 1963.

Local gas distributors throughout Oregon and Washington are eying possibilities for underground projects.

▼ ▼ ▼

**Transcontinental Gas Pipeline** just won't be counted out of the fight to move LPG into the Southeast, despite progress of the rival Dixie line in the same area.

Transco officials aren't talking for publication, but industry sources say they still are considering several alternatives, one of which has intriguing implications.

Transco has found it's physically possible to **ship mixed natural-gas liquids** in vapor phase through its existing gas trunkline. The liquids would move into the line at source points and then be stripped out at an enormous plant at the eastern take-off point.

Transco's gas-gathering lines on the Gulf Coast also would be used to **tap producers**

**who are remote from processing plants** and have had to flare liquids particularly during the summer. Producers would be willing to make long-term contracts to get a market—something producers usually do not do with processors. These contracts might make it possible to woo eastern distributors from suppliers backing the Dixie line.

**Another ace-in-the-hole:** Transco's plan to build underground storage at Jonesboro, Ga., a real selling point for all participating parties.

But the alternative which may still be the most realistic is a merger of Dixie and Transco forces, although Dixie currently is rejecting the idea.

▼ ▼ ▼

Some topics encountered on the **Washington beat:**

**Gas industry is facing decision** on what to do about tighter regulations currently being pushed in Congress by state utility commissioners.

Industry can oppose pending bill (S. 666) outright. Or it can offer compromise amendments aimed at including fair market price as guide for setting initial prices and regulating price hikes.

Tipoff may come when industry representatives testify next week before Senate Commerce Committee. However, it may be decided to hold up on such a move until legislation reaches House.

OCDM may soon reveal its views on whether asphalt content of asphaltic crudes should be **exempt from import controls.** Problem's been lying dormant at agency for several months.

**Visit of Russian gas experts** to U. S., originally planned for mid-May, has been postponed until after U. S. group tours Soviet Union in July.

Percentage depletion, natural-gas regulation, and import controls will be discussed at an **energy institute** in Washington June 26-30.

Top-ranking officials from industry and government are on program. Institute is sponsored by American University.

▼ ▼ ▼

**Mid-Continent refiners** can compete with **Gulf Coast suppliers** in making ethylene.

Engineers for M. W. Kellogg show this clearly in the following cost study: A 50,000-bbl. Mid-Continent refinery can produce ethylene at cost of 2.79 cents per pound. Same refinery on the Gulf Coast has a cost of 3.03 cents per pound.

Both cases are based on required purchase of natural gasoline to augment regular crude run. Why the advantage for the Mid-Continent? Feed costs are cheaper there.

Those reports that a **crude line** will be built to link Mexico's Tampico area with Brownsville, Tex., are false, according to R. B. Kahle of Houston, reportedly one of the principales in the project.

Kahle says such a plan was talked in Mexico 2 years ago—but there's nothing brewing

today. The latest reports stemmed from the imports of crude into Brownsville by tanker and double trucking to avoid quota restrictions.

**Coming next month:** Step-up in movement of Alberta crude into U. S.

Nominations filed with Alberta Oil & Gas Conservation Board show 161,000 bbl. daily will move into Puget Sound and Great Lakes areas. Figure for May is 135,000 bbl.

However, board estimates July imports will drop to 156,000 bbl. daily and August will see still bigger drop to 132,000 bbl.

**Propane stocks** are running higher than ever.

At April's end, total was up to 624.3 million gallons. Previous high for end of April was 384.5 million gallons in 1959, not far above the 354.3 million gallons at end of April last year.

**Another record:** Total LPG and LRG in storage at end of April this year amounted to 1.16 billion gallons compared with 732.1 million gallons a year earlier.

▼ ▼ ▼

Russia's backing up its boast that it intends to build the world's largest gas-pipeline system.

**First major section** of planned 4,000-5,000-mile gas-transmission network has been completed (p.118). It's a 475-mile stretch of 20 and 27-in. line from Dzharkak field, near Bukhara, to Tashkent.

**Next big step** in construction plans: Two 40-in. lines running side by side for 1,200 miles from Gazli field—also near Bukhara—to Chelyabinsk. One of these lines will continue another 150 miles to Sverdlovsk.

Lines will be **world's biggest in diameter.**

Soviets count on massive increase in Central Asia's gas output to replace 25 million metric tons of coal now used in Urals industrial area. Freed coal will take place of oil being used inside Russia, and this "extra" oil will be added to Russian crude exports into free-world markets.

Russians have come up with **portable, automatic aspirator** to measure round-the-clock differences in air-pollutant concentrations.

Device is mentioned in Soviet scientific paper translated for U. S. Department of Commerce under Public Health Service program.

Paper says aspirator gives **hourly picture of pollutant content** of air within a city, or at any desired distance from point of pollutant discharge. Commerce Department offers details and drawings to public through Office of Technical Services.

**In the wind:** Some college curricula committees are sure to give serious thought to **peeling "frill" subjects** from technological courses.

Reason is that some oil companies are going in for more "on the job" training, and recruiters are being coached to pick candidates with **solid basic education.**

Trend toward possible revamping of courses is reported by W. R. Horsley, placement director of Texas A & M College and past president of College Placement Council, Inc.

# Market memo

May 29, 1961

Marketing executives may need to recheck their internal channels of information.

There's evidence poor information may be a minor factor in market instability. Two cases in point:

. . . **Take refinery runs.** One marketing vice president tells the Journal too many firms base refinery runs on over-optimistic demand estimates which come up from sales districts.

No sales manager ever will admit he's not going to sell more in the future. He knows he can blame failure to meet the quota later on the weather, a grasshopper plague, recession, or what have you. He'll nearly always submit an optimistic estimate of product need.

This executive pleads for companies to demand hard-nosed sales estimates and to keep runs within them. It's best way to avoid sloppy product markets and price erosion.

. . . **Take price wars.** Another marketing executive in the East complains all too often price wars develop from poor information.

Some top marketing men will authorize a price cut in a market on affidavit from a dealer in the area that a competitor has cut. Later checks often show the dealer or a low-echelon company marketing man did not check the facts—they were just eager to get a temporary price advantage and increase gallonage.

This executive's thesis is that marketing management must exercise statesmanship in price-war situations, but this policy must extend right down to the dealer.

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The majors are beginning to **shore up gasoline prices** in the Charlotte price war.

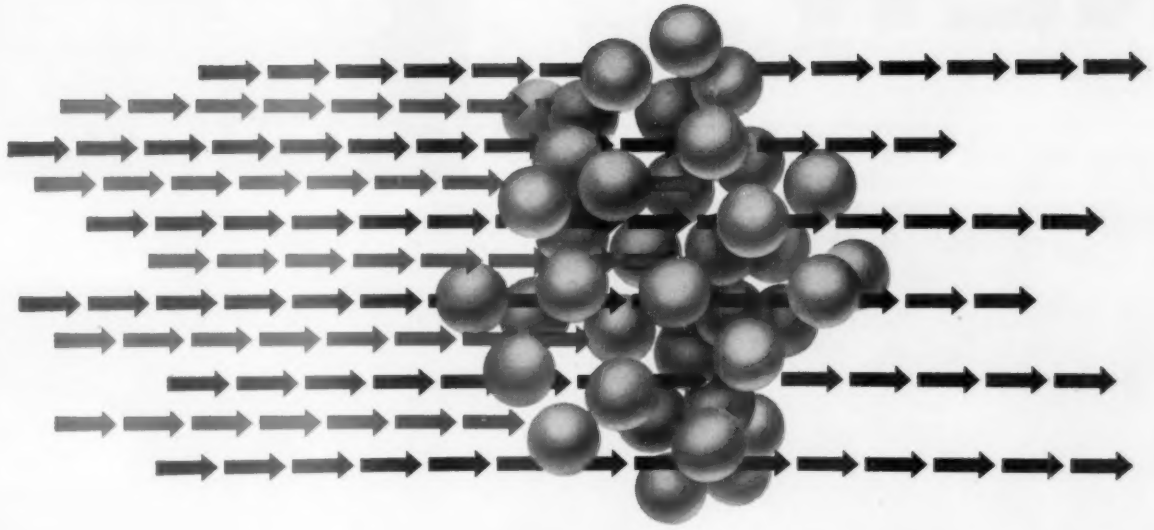
**Sun Oil** has posted an increase of 4 cents a gallon in the retail price of Blue Sunoco 200 gasoline at Charlotte and Gastonia, N. C. Move from 21.5 to 25.9 cents a gallon met the higher posting of house brand at stations of a major competitor. The price boost partially restores price cuts totaling 10 cents a gallon made during recent weeks.

**Esso** also has raised dealer gasoline prices in both North and South Carolina. The increases range from 1.6 cents at Charleston to 4 cents at Charlotte.

While gasoline prices held steady in other East Coast areas and on the Gulf Coast, **signs of price weakness** still were evident in the Mid-Continent. Discounts of one-fourth to one-half cent off the 11.25-cent posting were reported in upper sections of the region. But in Los Angeles, prices are firmer with rack prices on all grades up 0.6 of a cent.

**Price of distillates** also edged lower in the Mid-Continent. With postings one-fourth cent off, new prices were 9.25 cents per gallon for No. 1 and 8.25 for No. 2.

On the East Coast, Atlantic increased its "off season allowance" to resellers of distillates from one-half cent to a full cent a gallon in Pennsylvania and Delaware. The same discount is being applied to tank wagon accounts, and a new one-half cent allowance is given for the first time to tank car accounts. Other companies have yet to follow the plan.



# Davison Microtraps

## the selective adsorbent that's "custom-tailored" to your refining

The miracle of selective adsorption through the use of Davison Microtraps promises to write new chapters in the annals of refining operations. Now after extensive research and development work with the petroleum industry, Davison offers a superior selective adsorbent for your process.

### DAVISON . . . A proven source of Microtraps

Microtraps are the newest addition to the complete line of adsorbents and catalysts Davison produces for the petroleum, natural gas, and chemical industries. Davison Microtraps are available now, in quantity to meet your largest or smallest order.

### "Custom-Tailored" . . . not custom priced

Through Davison's exclusive processes, Microtraps can be produced in a variety of shapes and sizes that exactly match your refining requirements. These beads and other shapes combine superior attrition resistance with selective adsorption characteristics to make Davison Microtraps the perfect answer for many refining and drying operations.

### Pore sizes for your application

Davison Microtraps are available with pore openings of 4, 5 or 13 Angstroms. Whether your application involves selective separation, purification or dehydration, Davison can supply the exact size, pore diameter and shape you want at *lower prices than were considered possible as recently as a year ago.*

### Investigate Davison Microtraps

Evaluate the economics of Davison Microtraps for your refining or natural gas application where the use of a highly selective molecular adsorbent is indicated. For complete details, prices, and delivery of Microtraps, contact Davison.

**GRACE**

**DAVISON CHEMICAL**

**Petroleum Chemicals Dept.—A-05**
**Baltimore 3, Maryland**

# NEW

## engine power
BY CATERPILLAR

NEW KW

NEW HP

## CAT D343
gives you outstanding performance at an unmatched price per horsepower

Turbocharged-Aftercooled D343 provides 420 HP maximum at 2000 RPM, electric set produces up to 250 KW.
Turbocharged only—360 HP maximum with electric set ratings to 200 KW.

## CHECK ALL THESE MONEY-SAVING ADVANTAGES:

**SUPERIOR FUEL ECONOMY**
- As low as 0.387 lbs. per brake horsepower hour

**OUTSTANDING PERFORMANCE**
- 420 HP maximum . . . up to 250 KW
- Modern design . . . Turbocharged and Aftercooled
- Four valves per cylinder with individual porting
- Precise valve action with twin overhead camshafts
- Complete combustion through four-cycle design . . . full stroke power

**LOW OPERATING COSTS**
- Foul-free operation . . . large single-orifice fuel injectors
- Efficient burning of wide range of fuels because of pre-combustion chamber design

**LONG LIFE**
- Performance-proved Caterpillar-quality components
- Maximum cooling efficiency . . . wet-type cylinder liners, constant-spray-cooled pistons, high water-flow head
- Large-capacity dry-type air cleaner . . . double oil and fuel filtration systems

**EASE OF SERVICE**
- Tinker-free fuel system . . . no adjustments needed
- No valve train mechanism with twin overhead camshafts

*All Caterpillar Engines are backed by over 800 sales, parts and service outlets throughout the Free World. Call your Caterpillar Dealer or write us direct for complete specifications on the new D343.*

# CATERPILLAR

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Caterpillar Tractor Co., Engine Division, Peoria, Illinois, U. S. A.

B.F.Goodrich

# V belt briefs

TIPS ON THE CARE, MAINTENANCE AND SELECTION OF V BELTS FOR INDUSTRY

## The right way to install and run-in V belts

To get the most possible life out of a set of V belts you've got to install them and run them in properly:

*To install V belts:*

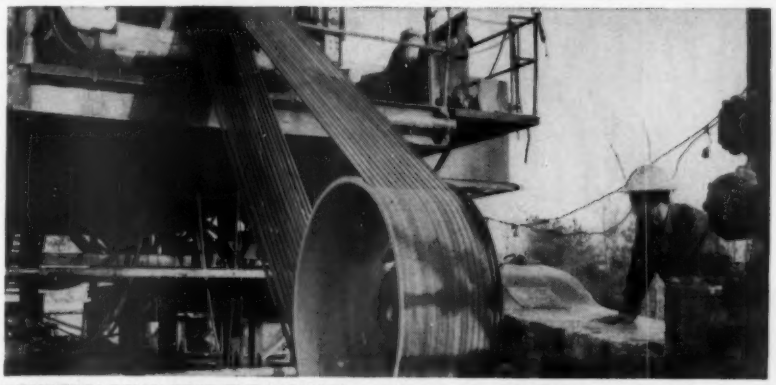
1. Move driver unit toward driven machine so that belts may be placed in sheave grooves by hand.
2. Work belt slack to top side of drive.
3. Move driver unit back into position, eliminating all belt sag.
4. Check sheave alignment.

*To run-in V belts:*

1. Start unit and operate long enough to permit belts to properly seat in grooves.
2. Stop unit. Adjust centers as necessary until all belts have proper tension.
3. Review adjustment from 24 hours to 48 hours after drive is in operation. This is important, for new belts stretch slightly and seat in grooves before reaching their working lengths.

## It pays to keep belts stored properly

V belts should be stored in a cool, clean, dry place. Avoid heat and direct sunlight. Do not hang on nails or other small objects which might cause a sharp bend or tension that would result in a permanent set in V belt. Oldest belts should be used first to keep fresh stock. Matched belts should be banded together so they don't become separated.

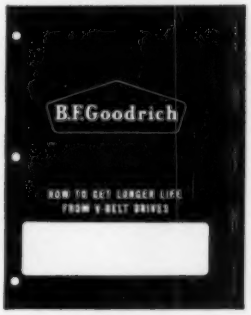


**FOURTEEN BELTS BEAT THE WEATHER**—*These B.F.Goodrich Grommet belts have stood dirt, dampness, all kinds of weather and the heavy shock loads of a mud pump since they were first installed over 2½ years ago. They've required less takeup than any other belts used by this drilling company, have not caused any shutdowns. When the picture was taken these belts showed little cover wear, looked good for many more years of trouble-free service.*

## What caused this V belt failure?

*Answer:* Prematurely worn sides are caused by grit, dirt or any such abrasive contact. Misalignment often causes wear on one side only. To prevent, align the sheaves, checking with straight-edge or cord. Keep belts and sheave grooves clean.

## B.F.Goodrich V belt manual




The illustrated pages of this new B.F.Goodrich V belt maintenance manual contain information that will help you get longer life from your V belt drives. Its 12 illustrated pages contain information on how V belts work, how to select V belts that fit, how to install, how to keep them running, and how to spot trouble. To get your free copy, call any of these B.F. Goodrich warehouses: Los Angeles, Great Bend, New Orleans, Hobbs, Shreveport, Oklahoma City, Tulsa, Corpus Christi, Dallas, Houston, Kilgore, Odessa, Wichita Falls. *B.F.Goodrich Industrial Products Company, Department M-109, Akron 18, Ohio.*

## Take a look inside with this X-ray of a Grommet belt

This model of a B.F.Goodrich Grommet belt was made of a transparent, flexible material so that you can see its grommet construction. The two endless loops you see are grommets, the load-carrying members of the B.F.Goodrich belt. These are made by winding heavy cord on itself to make an endless cord grommet.

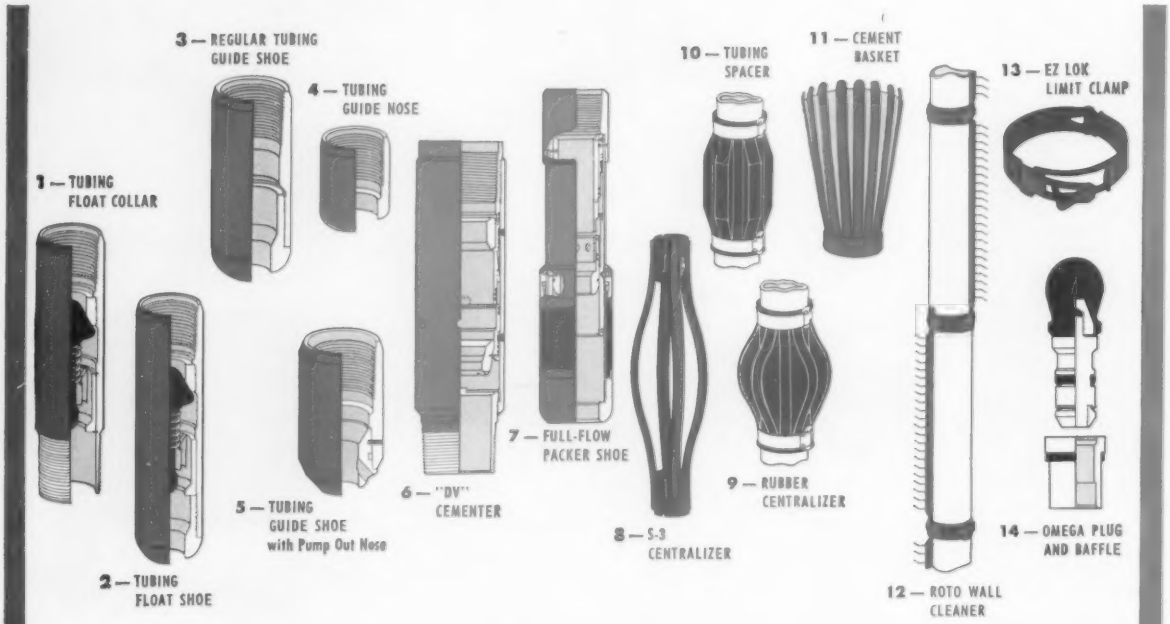
In the actual belt, these grommets float in a bed of solid rubber. You can *see* why every part of the belt is equally flexible—there are no stiff plies to resist bending. Most cord failures occur where cords overlap. But in the B.F.Goodrich Grommet belt with endless cord construction this cause of failure is eliminated.

# B.F.Goodrich V belts

# LOOK WHAT IS NEW FOR TUBINGLESS COMPLETIONS!

HALLIBURTON has now developed this complete line of Tubingless Completion Tools. Each one incorporates the dependable features designed into the larger sizes and proved in years of successful service.

In tubingless completions, the tools are scaled down – but Halliburton's services are *full size!* The capable combination of Halliburton men, materials and equipment is backed by nearly 40 years of servicing experience. Whatever you require for tubingless completions – cementing, treating, testing, or remedial services, you'll find exactly what you need when you call Halliburton.


3 — REGULAR TUBING GUIDE SHOE
4 — TUBING GUIDE NOSE
1 — TUBING FLOAT COLLAR
2 — TUBING FLOAT SHOE
5 — TUBING GUIDE SHOE with Pump Out Nose
6 — "DV" CEMENTER
7 — FULL-FLOW PACKER SHOE
8 — S-3 CENTRALIZER
9 — RUBBER CENTRALIZER
10 — TUBING SPACER
11 — CEMENT BASKET
12 — ROTO WALL CLEANER
13 — EZ LOK LIMIT CLAMP
14 — OMEGA PLUG AND BAFFLE

**HALLIBURTON CEMENTING TOOLS for tubingless completions**

**TUBING FLOATING EQUIPMENT** **1** and **2** incorporates the Super Seal Valve to help reduce the load on surface equipment and act to prevent cement from backing up after placement. This valve provides full opening through its seat. For 2⅞" and larger sizes, Automatic Fill-Up Attachments are available to allow tubing to automatically fill, thus reducing running-in time.

**TUBING GUIDING EQUIPMENT** directs the string away from ledges and obstructions in the hole. Regular Tubing Guide Shoe **3** is equipped with a drillable cast aluminum guide nose. The small Guide Nose **4** is of full opening design while the other Guide Shoe **5** is equipped with a pump out nose. Neither 4 or 5 normally requires drilling-out.

**TUBING "DV" MULTIPLE STAGE CEMENTER** **6** permits placing cement in separate stages to help protect specific intervals for dual zone or multiple completions, to help protect weak or porous formations, and to permit full depth cementing in deep holes.

**TUBING FULL-FLOW PACKER SHOE** **7** helps protect formation below while cementing tubing or casing. Requires no drilling out after cement placement since internal parts and plug may be pumped free from tool leaving a full opening.

**TUBING CENTRALIZERS** keep the string centered to help avoid cement channeling. The Model S-3 **8** is equipped with heat treated steel springs to give maximum centering force. The 85 durometer Rubber Centralizer and Spacer **9** and **10** are applied quickly with metal banding. The Spacer is also designed for use in multiple string completions.

**COMPANION CEMENTING EQUIPMENT** The Cement Basket **11** aids in protecting weak or porous formations by adding support for the cement column. Tubing Roto Wall Cleaners **12** are designed to permit better cement bonding and reduce channeling by cleaning filter cake from the wall bore prior to cementing. EZ Lok Limit Clamps **13** provide "snap-on" locking power to speed the installation of companion equipment without welding.

**OMEGA LATCH DOWN PLUG AND BAFFLE ASSEMBLY** **14** incorporates a dual purpose top cementing plug that wipes tubing free of cement, and, when latched in its Baffle, provides a back pressure valve effect to help prevent reverse flow of cement.

## HALLIBURTON TOOLS for cementing, treating and testing in slim hole and tublingless completions

### PACKERS AND BRIDGE PLUGS

**SDC SQUEEZE PACKER** **A** , tested to seal up to 10,000 psi differential pressures, is designed to effectively pack-off inside 2⅞" O.D. regardless of depth. Built-in back pressure valve helps prevent reverse flow of cement after squeezing. SDC can be easily converted to a bridge plug if desired.

**RTTS PACKER** **B** is a retrievable tool designed to be run inside 2⅞" O.D. and larger tubing for treating, testing and squeezing one or more zones during the same trip. The tool is equipped with a circulating valve and safety joint.

**WLC BRIDGE PLUG** **C** is normally set on a wire line to plug a zone for abandonment or treating above the plug. It is made of drillable materials and is designed to effectively hold 10,000 psi differential pressures.

**RETRIEVABLE TENSION PACKER** **D** is equipped with its own Circulating Valve. This Packer is set in tension to isolate a zone inside tubing for fracturing, acidizing, squeeze cementing, and other pressure treatments.

**CUP TYPE RETRIEVABLE BRIDGE PLUG** **E** is designed to provide a positive but easily removable plug inside tubing to seal against differential pressures. It is especially adaptable to be run below the RTTS Packer to straddle several separate zones for treating, testing or squeezing during one trip into the hole.

**TUBING R-3 TREATING PACKER** **F** may be tension-set or inverted for conventional setting inside 2⅞" O.D. tubing to isolate a zone to be treated or produced. This retrievable tool is designed to hold 5,000 psi differential pressures. All parts below the built-in safety joint are drillable.

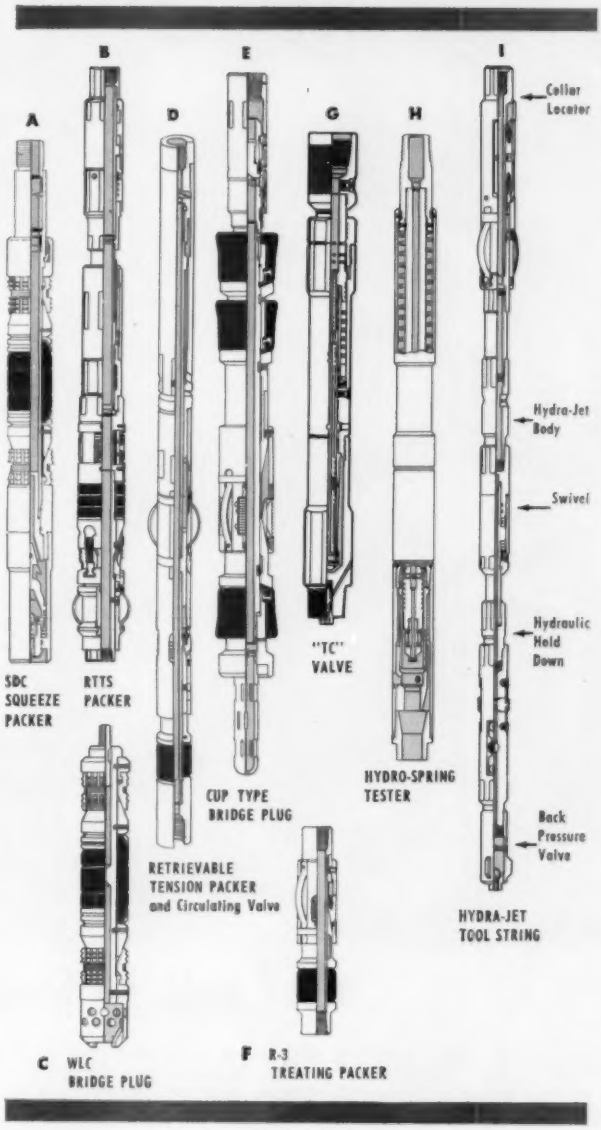
### TUBING TESTING TOOLS

**TUBING "TC" CIRCULATING AND CLOSED-IN-PRESSURE VALVE** **G** eliminates the need for air chamber in obtaining initial C.I.P. build-up, flow pressure and final C.I.P. All phases of operation require only right-hand drill pipe rotation. Available for running tests in open hole, 3½" I.D. and larger.

**TUBING HYDRO-SPRING TESTER** **H** opens easily by slacking off weight. Ease of maintenance and operating simplicity are valuable features of the Hydro-Spring Tester.

### TUBING HYDRAULIC ABRASION TOOLS

**TUBING HYDRA-JET EQUIPMENT** **I** directs high pressure streams of sand laden fluid to perform such functions as perforating, horizontal or vertical fracture initiation, slotting or cutting tubing, and other remedial work. The string includes a Collar Locator to position the tool, the Hydra-Jet tool with its jetting nozzles, the Tubing Swivel if it is desired to rotate during jetting, a Hydraulic Hold Down and Back Pressure Valve Assembly.




These are the Halliburton Tools that help you extend your savings in tubingless completions. For more information, see your Halliburton man, *today!*

*275 Service Centers*
*. . . just minutes away*
*from your well*

TUBINGLESS COMPLETION TOOLS

**Halliburton**
COMPANY • DUNCAN, OKLAHOMA

# need help on foaming problems?

If you operate a gas treating unit using ethanolamines or ethylene glycols, chances are foam is nothing new to you. It's not necessarily a sign of trouble. But if foam is too stable, you may soon be up to your ears in foaming problems.

**What to do:** Proper care of the amine or glycol solution is the best cure for foaming problems. Start with materials of guaranteed purity, ethanolamines and ethylene glycol from Allied Chemical.

- In amine systems, first preventive steps are proper reclaimer operation and adequate filtration – using activated charcoal, in some cases, to adsorb foam-generating materials.
- In glycol systems, first steps are proper pH control, adequate filtration and provision for good separation of hydrocarbons and glycols.

**How to rate your unit on foam:** Bubble air through a 50-ml. sample of plant solution in a graduated cylinder, using either a medium or fine fritted glass dispersion tube. You'll need a means of measuring air flow so rates will be reproducible. Use two or three rates—e.g., .03, .05, and .10 cu.ft./min. Both at room temperature and at about 50°C (122°F), observe:

1. Type foam formed (bubble size, apparent consistency).
2. Time required for foam to reach maximum height.
3. Time required for foam to break after air flow is stopped.

Repeat same test on equivalent amine or glycol solutions made up from fresh, unused amine or glycol and compare results. If the plant solution has an appreciably greater tendency to form stable foams of uniformly large bubble size, get ready for trouble.

**What about foam inhibitors:** Remember, these don't solve the basic problems, but merely give control until you locate the cause of the foam and correct it. Also, how they act may depend on whether they are added *before* or *after* the foam is generated.

For more help, write for "Report on Foaming Problems". We'll also be glad to send you technical data, delivery and price information on Allied Chemical Ethanolamines and Ethylene Glycols.

*For specs and local offices, see Chem. Materials Catalog, page 272A; Chem. Week Buyer's Guide, page 27.* 2819

Allied Chemical

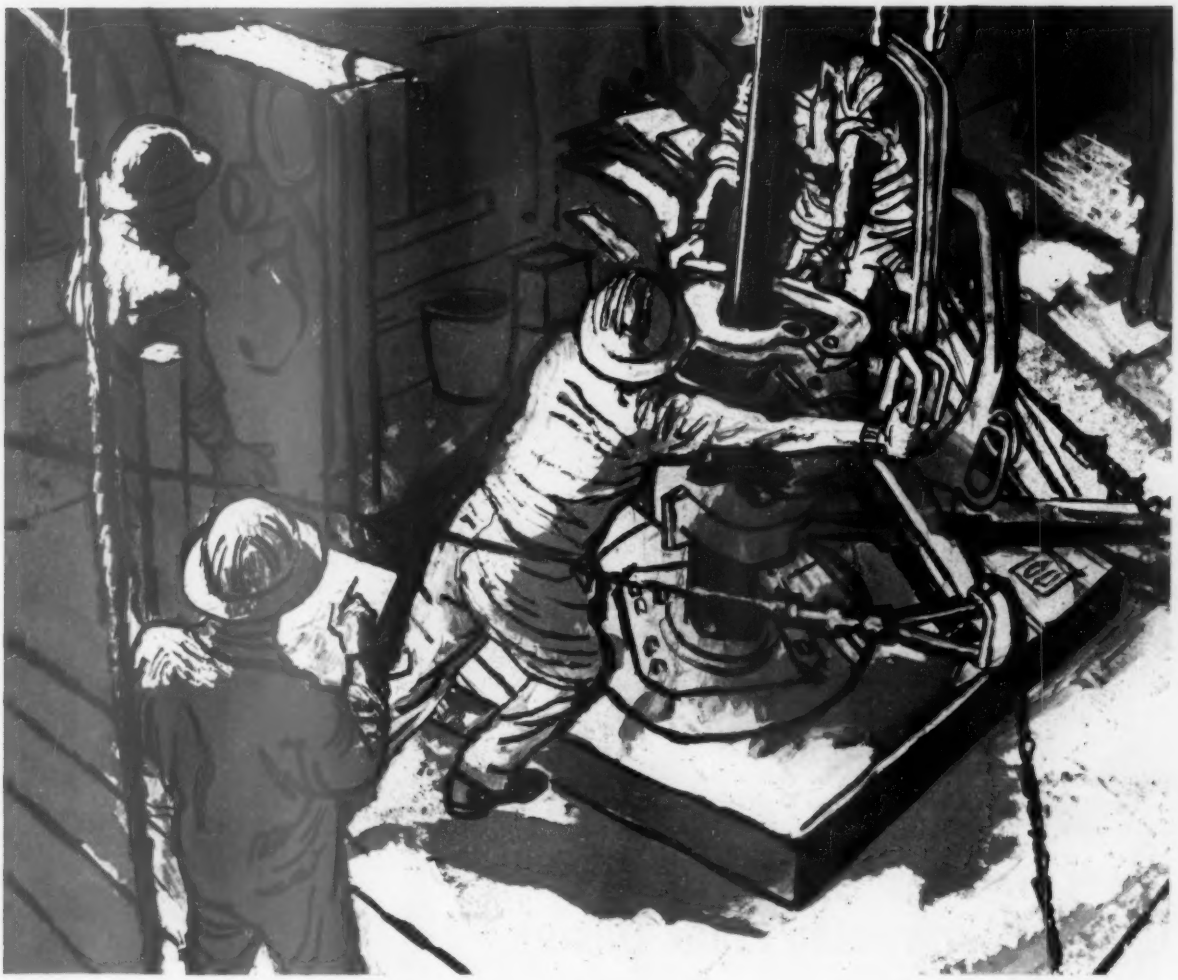
BASIC TO AMERICA'S PROGRESS

**NITROGEN DIVISION**

Dept. GA 6-55-1, 40 Rector St., New York 6, N.Y.

# PROTECTION IN DEPTH

## How it helps cut compensation costs



## Making hazardous work less hazardous

Making up a joint is rugged work. Handling the slips and drill pipe, throwing chain and operating the tongs are all hazardous functions on the derrick floor. Poor housekeeping and lax maintenance needlessly add to the risks. By checking your rig carefully and pointing out these hazards, a Liberty Mutual loss prevention engineer can help you improve your odds against worker injury.

But safety engineering is just the beginning of Liberty's protection in depth. This broad concept in loss control also includes a full-time auditing staff, two rehabilitation centers, a special paraplegic ward, and the diagnostic services of leading orthopedic specialists in 78 cities. At Liberty's research center, technicians study ways to help make machines, methods, and environments safer.

These and other services of Liberty's protection in depth helped save many millions of dollars for Liberty Mutual workmen's compensation policyholders last year. To learn more about Liberty's protection in depth (and how it can save *you* money), just call the nearest Liberty Mutual office.

**Look for more from**

# LIBERTY MUTUAL

**the company that stands by you**

LIBERTY MUTUAL INSURANCE COMPANY • LIBERTY MUTUAL FIRE INSURANCE COMPANY • HOME OFFICE: BOSTON

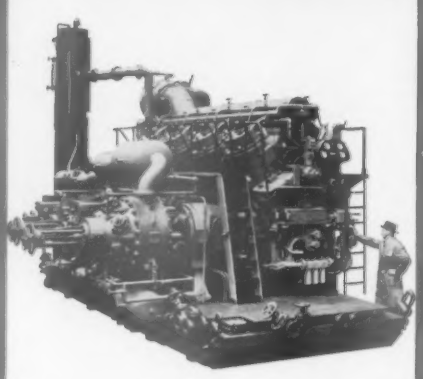
**Personal Insurance:** Automobile, Fire, Inland Marine, Burglary, Homeowners • **Business Insurance:** Workmen's Compensation, Liability, Group Accident and Health, Fire, Inland Marine, Fleet, Crime

*From Attic Oil to Retrograde Condensation . . .*

# C-B/S Compressor Plant Designs Solve Your Problems in Gas Injection

To build a compressor plant, whether it's 100 bhp or 1,440 bhp, to operate with economic efficiency in a gas injection system, the manufacturer must be able to recognize and understand your problem. C-B/Southern builds compressor plants which meet the complex requirements of artificial recovery such as pressure maintenance, cycling, and other secondary recovery operations. Here is experience drawn from building more than 40,000 compressor horsepower last year, much of it for gas injection systems, and the years C-B/S people have spent as oil and gas engineers. That is why C-B/S knows how to design and build the compressor unit that works most economically and most efficiently with your gas injection system.

*And remember:* C-B/S compressors are available in sizes from 100 to 10,500 horsepower.



This 1,440 horsepower plant is capable of handling more than 6½ MMCFD with injection pressures up to 5,000 psi. It is now in use in a major producing area.

CB/S

PACKAGED COMPRESSORS

CB/S

**C-B/SOUTHERN, P. O. BOX 19267, HOUSTON 24, TEXAS, HOmestead 8-5441**

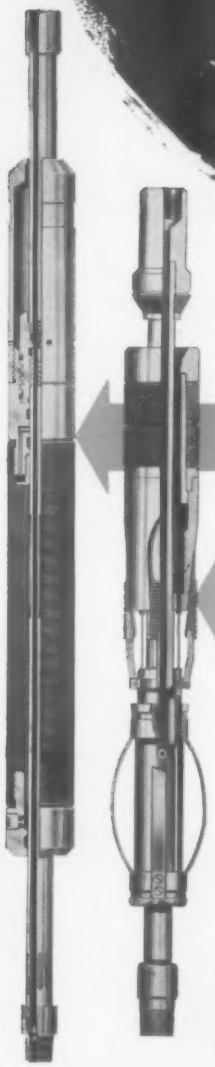
*A division of The Cooper-Bessemer Corporation*

MANUFACTURERS OF PACKAGED COMPRESSOR PLANTS FOR GAS GATHERING, GAS LIFT, GAS INJECTION APPLICATIONS

# LYNES

## BRIGHT NAME IN THE OIL PATCH

*Inflatable Sealing Element Packers*



**Lynes inflatable packers successfully seal with complete safety in open hole or casing to reduce production costs and for economical, positive open hole formation treating and testing. Holds against high differential pressures above or below without weight, hold down, slips, or tailpipe. Does many jobs other tools cannot attempt.**

### "PIP" PACKER

Sales packer for all production uses.

### CONVENTIONAL TYPE PACKERS

LYNES has a complete line of hook wall packers, proved in years of service in every oil field in the world.

### INFLATA-TEST TUBING PRESSURE TEST SERVICE

LYNES modern, trailer-mounted tubing test units utilize the positive holding power of the LYNES inflatable sealing element for fast, money saving on-location test service of all tubing including plastic lined and rough tubing.

*Look to LYNES for the newest ideas, for the best service in the oil fields.*

### WILDCAT SERVICE PACKER

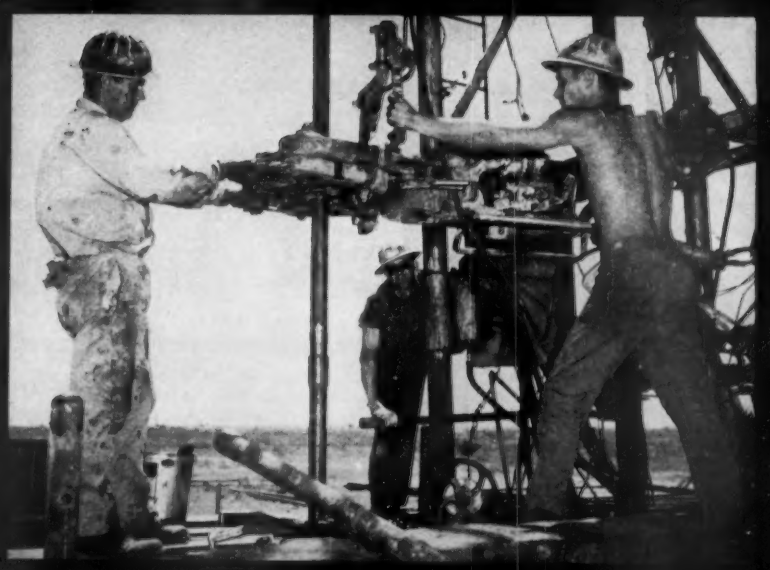
Single or straddle packer, opens above, below and/or in between. Can be moved and re-set without coming out of hole.

**LYNES, INC.**

P. O. Box 12486 · Houston 17, Texas

SUPPLY

Production kinks and



# costs.....here's real help

Performance proved production equipment from J&L includes: portable waterflood units; Major MACT units; J&L casing and tubing, including slim hole and macaroni; Cabot pumping units; Axelson rods and Axelson bottom hole pumps.

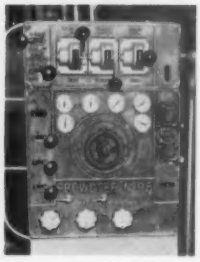
J&L engineers and production specialists will back your determination to raise efficiency and lower end-costs.

If it's sold by J&L, it's the best available. You can depend on J&L equipment, experience, and service. Call your J&L Supply man or write us in detail—1425 Sheridan Road, Tulsa.

**Jones & Laughlin Supply Division—Tulsa**

# The Guts of a Rig is its DRAWWORKS

**And when you choose Brewster drawworks . . . you know it's so.**
**It takes bold, lusty power to make hole. Positive power, fast and sure.**
**Brewster gives you this . . . trip after trip.**
**Again and again.**



BREWSTER

***DEPTH RATING . . . . . 12,000' to 14,000'***

***TOTAL HORSEPOWER . . . . . 1,200***

***Torque Converter, Fluid Coupling or Mechanical Drives. Heavily Shafted and Chained, the N-95 Drawworks Will Accept the Full 1,200 H.P. at the Drawworks Input Shaft.***

**DRAWWORKS**

The Brewster N-95 is a single package side skidded drawworks. Integrally mounted on the main skid are the control panel, built-in transmission and hydromatic brake with all piping and water level tank. When placed on the drilling floor the drawworks requires the connection of only two chains to be ready for operation . . . one chain from input shaft to the compound . . . one chain from rotary drive to the table.

High and low, rotary and input clutches are latest design, high capacity, air-actuated Twin-Disc plate clutches. Clutches are mounted outboard for ease of servicing. Shaft assemblies are complete units and may be removed in the field for maintenance or service. All chains and high speed bearings are oil pressure lubricated. Drum shaft bearings are grease lubricated.

**TRANSMISSION**

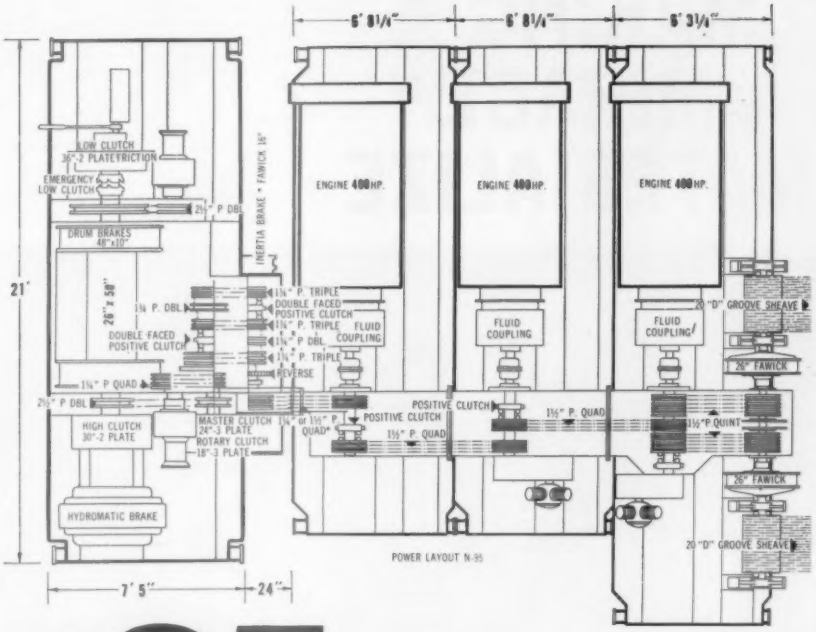
The compact chain transmission is enclosed in an oil-tight housing in the rear of the drawworks frame. It features Brewster's field-proved graduated-speed design with four forward speeds, each a 38% speed increase. A gear reverse is provided. When combined with the high and low drum drives, eight forward and two reverse speeds are available for hoisting. A third shaft in the transmission enables the driller to select a high or low rotary speed independent of the hoisting speed. All transmission clutches are air-actuated and air-interlocked to prevent engagement of opposing clutches.

**COMPOUND**

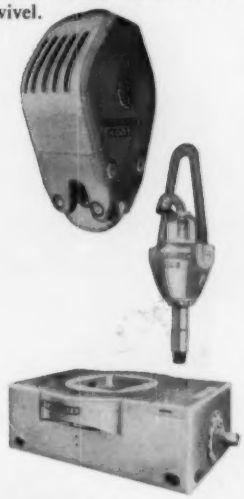
The N-95 is available with two types of compounds, sectional and heavy duty box type. Single and split level arrangements are available. Engines are coupled to the compound through Fawick air clutches which also serve as flexible couplings and act as engine disconnects when moving the rig. When fluid couplings or torque converter drives are used, engines can be coupled to compound by a flexible coupling. Compounding clutches are gear-tooth type and can be actuated singly or in groups giving a wide variety of compounding arrangements.

**PUMP DRIVES**

Single or dual pump drives are mounted at the rear of the compound. They are connected to the compound through Fawick air clutches. Air controls at the driller's position permit the drives to be used singly or together and at different speeds. Mounting of both pump drives at the rear of the compound simplifies rigging-up and manifolding . . . eliminates the need of idlers or notching the substructure.




Brewster Matched Drilling Equipment for the N-95 Drawworks includes the Model 400 Traveling Block, the RSH-22 Oil bath Rotary and the 7-SX Oil bath Swivel.



# n95 ROTARY RIG DRAWWORKS

## PERFORMANCE CHARACTERISTICS

| *Transmission Speeds* | *Cathead Shaft R.P.M.* | *Rotary Drive Sprocket R.P.M.* | *Low Speed Drum Drive Line Speeds And Pulls* | *High Speed Drum Drive Line Speeds And Pulls* |
|---|---|---|---|---|
| Low | 109 | 216 | 326′/Min. 88,500 lb. | 1,235′/Min. 24,130 lb. |
| Second | 151 | 300 | 457′/Min. 67,100 lb. | 1,710′/Min. 18,490 lb. |
| Third | 210 | 470 | 632′/Min. 48,600 lb. | 2,380′/Min. 13,290 lb. |
| High | 292 | 653 | 879′/Min. 34,900 lb. | 3,310′/Min. 9,550 lb. |

Line pulls based on 1,050 h.p. with 83.3% Rig eff.

### BRAKES

Brakes are full 325° wrap, having 1⅛″ x 10″ linings on 50″ diameter drums, with a total braking surface of 2,836 square inches. Brake flanges are bolted to the main drum and are of the circulating water-cooled type. The compound equalizing and self-energizing brake design provides maximum holding power with little manual effort. Provision has been made to cradle mount a hydromatic or dynamatic brake on the side opposite the driller.

### CONTROLS

All controls for the N-95 drawworks, compound engines and pump drives are air-actuated. The simplified control panel is mounted as an integral part of the drawworks package. Its convenient location permits the driller to have a full view of the drum and all operations on the drilling floor. Controls provide a wide selection of engine compounding arrangements. Transmission clutches are operated by turning a single hand wheel to the selected speed.

### PORTABILITY

The N-95 has been designed for maximum ease in rigging down and moving. The entire rig can be moved in four over-the-road packages when the 3-engine compound is used. When the 2-engine compound is used, only three packages are required. The drawworks is separated from the compound by disconnecting a single chain and unbolting one guard. The controls, transmission, rotary drive and hydromatic brake are mounted on the main drawworks skid and moved as a single load.

### LUBRICATION

All chain drives in the drawworks, transmission and compound are oil bath and oil pressure lubricated. They are enclosed in oil-tight housings. All main shaft and sprocket bearings are pressure oil lubricated and drum bearings are grease lubricated. An abundant supply of filtered oil is supplied by separately driven oil pumps. Oil cooling coils are available for the compound.

*For more details ask your* Brewster dealer *or write* THE BREWSTER COMPANY, INC.

**THE BREWSTER COMPANY, INC.**
P. O. BOX 1095, SHREVEPORT, LOUISIANA

PRODUCTS OF CREATIVE ENGINEERING

# MAKING A MIRAGE MATERIALIZE

## PAKISTAN'S FIRST OIL REFINERY TO BE BUILT BY KELLOGG

### for British-Dutch-American consortium

Engineering is well under way at Kellogg for Pakistan's first refinery, near Karachi. Simultaneously, details of procurement—a world-wide operation—are being planned in Kellogg offices. As reported previously, construction is scheduled to begin later this year.

The Kellogg organization will be completely responsible for this 35,000 BPD refinery to Pakistan Refinery Limited. The Burmah Oil Company, Caltex, Shell, and Stanvac all participate in Pakistan Refinery Limited. Technical coordinator for the consortium is Bataafse Internationale Petroleum Maatschappij.

Important considerations in the selection of the Kellogg organization were cost, speed, ease of maintenance, and the proved ability to undertake and coordinate every phase of engineering, procurement, and construction. Kellogg's contract assures the minimum initial investment and operating costs consistent with good refinery practice and proper safety standards.

For companies considering oil refining or petrochemical manufacturing facilities overseas, Kellogg's international organization offers the optimum return on investments and the soundest kind of economic aid to friendly nations.

**THE M. W. KELLOGG COMPANY**

711 Third Ave., New York 17. *A subsidiary of Pullman Incorporated*

Offices of other Kellogg companies are in
Toronto, London, Paris,
Rio de Janeiro, Caracas, Buenos Aires

# "A great step forward with your Planetary Gears, Big Bearings and Cylindrical Crossheads."

OIL PRODUCTION MAINTENANCE, INC.
7440 CHOCOLATE BAYOU ROAD -- P. O. BOX 14291
HOUSTON 21, TEXAS
August 31, 1960

Mr. Gordon P. Street, President
The Wheland Company
Chattanooga, Tennessee

Dear Mr. Street:

Our Wheland Planetary Pump is giving us increased penetration and good savings on bits. We know from more than 18 months of constant operation on 10,000 Ft. wells that our savings are substantial.

We have kept an accurate record on operating costs and all maintenance costs and are especially impressed by the low cost of fluid end expendables. The HP-16000 Pump has constantly operated near its rated capacity on more than 200,000 feet of hole in the Texas Gulf Coast Area.

We are now operating Wheland HP-18000, HP-14000, and HP-16000 Pumps and are glad to recommend them. Your new HP-16000 Pump design is a great step forward with your planetary gears, big bearings and cylindrical crossheads.

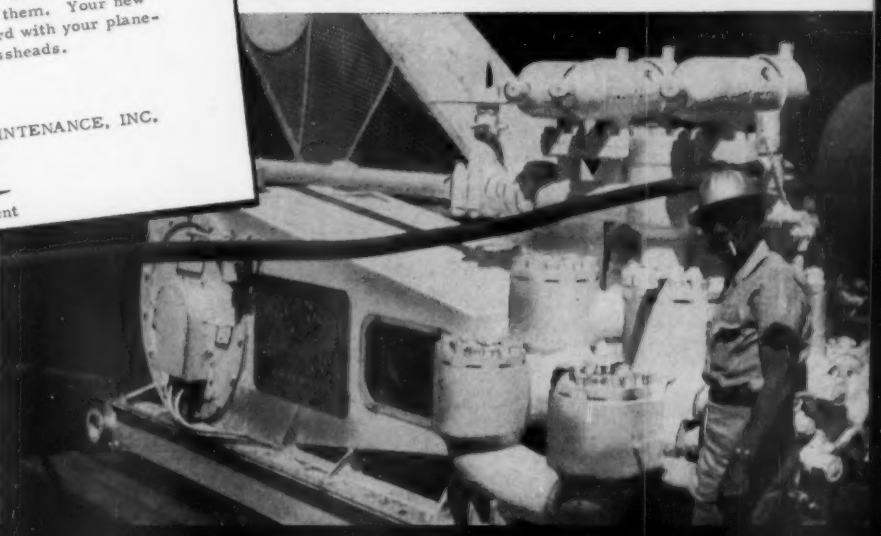
Yours very truly,

OIL PRODUCTION MAINTENANCE, INC.

J. K. Butler

J. K. Butler, President

**WHELAND PLANETARY**
**HP-16000 PUMP**
**Duplex Power Slush Pump**
**7¾" x 16", 600 H.P. at 65 RPM**



**Wheland HP-16000 Planetary Pump owned by Oil Production Maintenance, Inc., on location in the Gulf Coast area.**

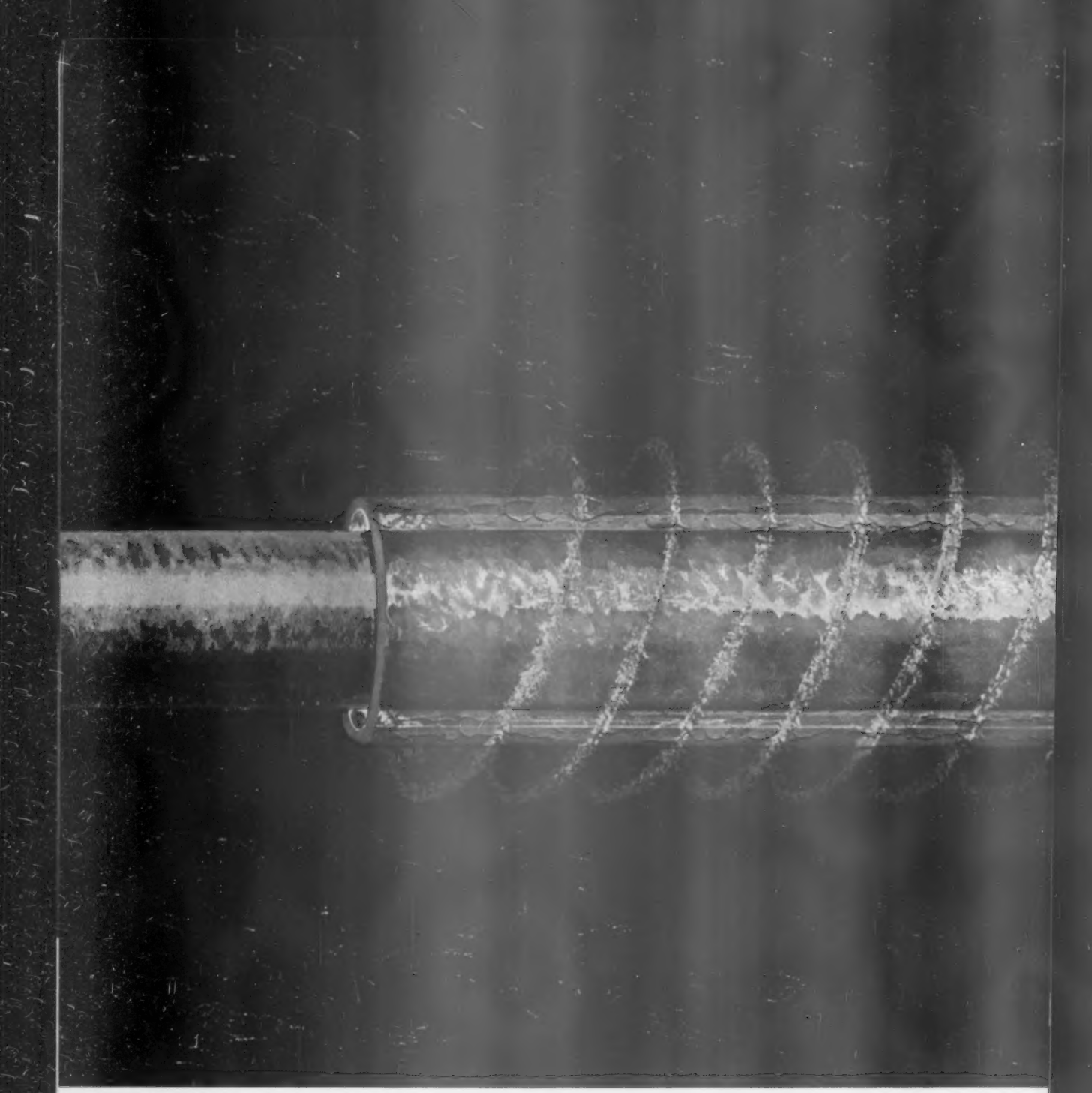
# WHELAND
## ROTARY DRILLING MACHINERY

**THE WHELAND COMPANY**
CHATTANOOGA, TENNESSEE, U.S.A.

**DRAW WORKS • SLUSH PUMPS • ROTARIES**
**CROWN BLOCKS • TRAVELING BLOCKS • SWIVELS**

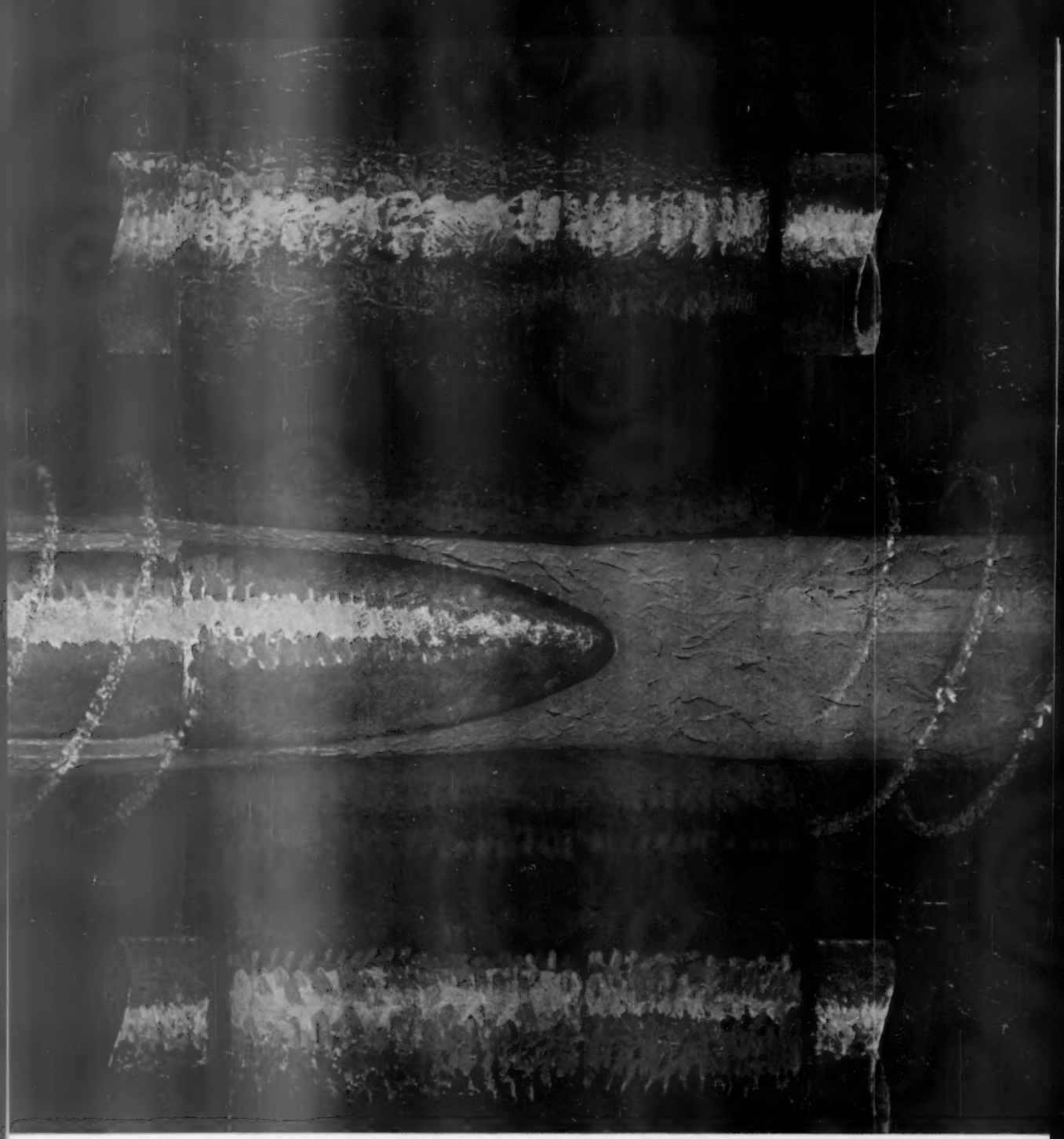
DOMESTIC DISTRIBUTORS: INDUSTRIAL SUPPLY COMPANY, INC.—Main Office: Wichita Falls, Texas • HOUSTON OIL FIELD MATERIAL COMPANY, INC.—Main Office: Houston, Texas.

EXPORT DISTRIBUTORS: LUCEY EXPORT CORPORATION—233 Broadway, New York 7, New York—Broad Street House, London, E. C. 2, England.



# What a tough way to come into the world!

This mark tells you a product is made of modern, dependable Steel.



The piercing operation is one of the first steps in creating seamless pipe from a solid section of steel. After we set the hot steel billet in place, we ram it. Spin it. Push its insides out. And stretch it into a hollow over six times longer than the original piece of steel.

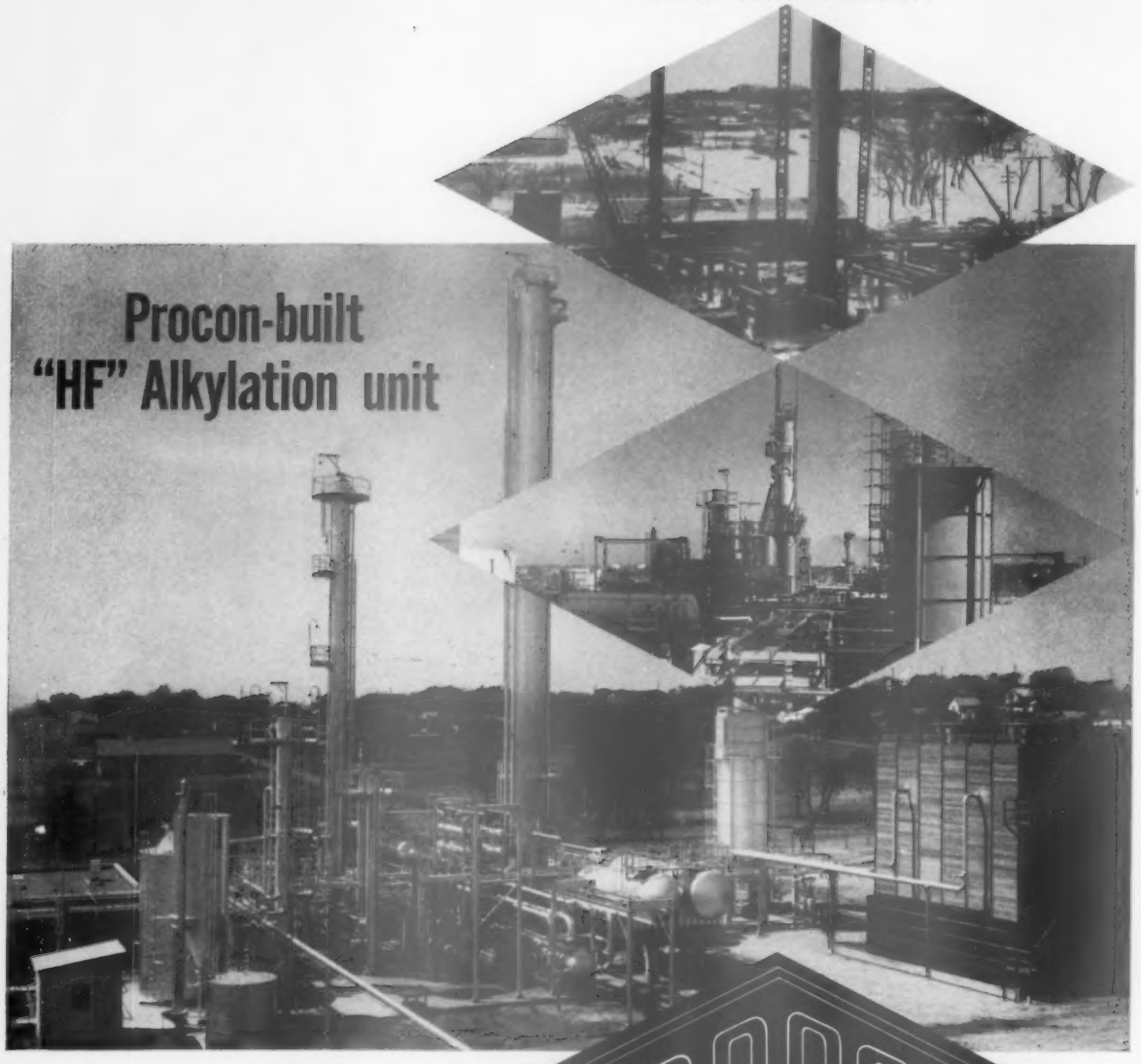
Only the highest quality steel can survive this forging operation—and the stress and strain encountered in drilling and production work. That's why USS National Seamless is the best pipe you can use in the oil country. For drill pipe, casing or tubing that can really take it, order USS National Seamless Pipe.

*USS and National are registered trademarks*

**National Tube Division of United States Steel**

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
United States Steel Export Company, New York

ON-SITE WITH PROCON



# Procon-built "HF" Alkylation unit

## ...on-stream ahead of schedule

Maintaining schedule during the construction of a processing unit requires the precise co-ordination and timing of a series of design, engineering, procurement and construction details. But to complete ahead of schedule requires the extras in experience . . . in judgement, that save minutes and days. A right decision . . . a proper procedure . . . a new technique, these are the *experience factors* that help PROCON build better and on time.

Procon completed this "HF" Alkylation unit, built for Midland Cooperatives, Inc., days ahead of schedule. Midland located in Cushing, Oklahoma, uses the high octane alkylate to supplement its premium gasoline.

Turnaround, unit revamping, one unit or a complete refinery from the ground up . . . whatever your requirement you can trust the entire job to PROCON.

WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, PETROCHEMICAL, AND CHEMICAL INDUSTRIES

**PROCON** *Incorporated*

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PROCON INTERNATIONAL S. A., CHICAGO, ILL., U. S. A.
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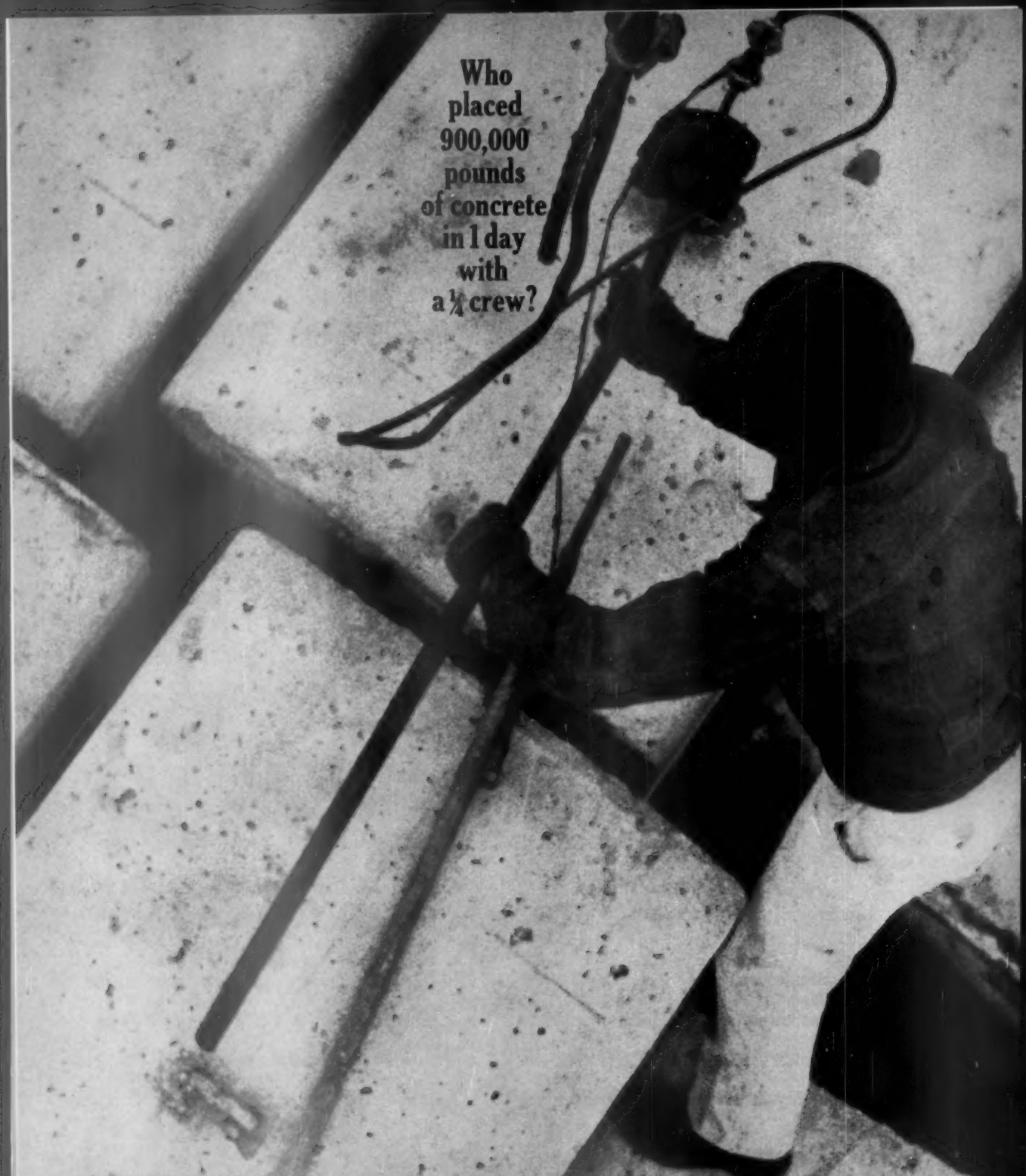
PROCON PTY. LIMITED, SYDNEY, AUSTRALIA
PROCOFRANCE S. a. R. L., PARIS, FRANCE
PROCON LIMITADA, SAO PAULO, BRAZIL
PACIFIC PROCON LIMITED, MANILA, P. I.
VICAPROCON, S. A., CARACAS, VENEZUELA




**A pilot operating a Sikorsky helicopter.** It would have taken two weeks and a full crew to do the job that was done in just *one day* last August. Petroleum Helicopters, Inc., working at Stevens Point, Wisc., for Houston Contracting Co., placed 320 concrete pipeline ballast weights at 2,800 pounds apiece, in swamp, in 6¼ hours. The job was done using a Sikorsky helicopter and ¼ of a normal crew. And that's not all. While the cost to place each weight by conventional methods could be as much as $75, the Sikorsky helicopter cut it down to $15 each . . . saving up to $60 per weight.

When you have a Sikorsky helicopter working for you, you save in dollars, you save in time, and you get a pipeline ready for work long before it would be by conventional methods. Why not write today for all the details.

Sikorsky Aircraft
Stratford, Connecticut
Division of UNITED AIRCRAFT CORPORATION

Memo to Management:

ONE BILL...ONE RESPONSIBILITY
MEANS A BIG SAVINGS TO US...

Whether it's power for a pipeline, refinery or pumping, many oil companies prefer to purchase dependable utility electric power and get all power bills on one convenient monthly invoice. Utility electric power works 24 hours a day or operates on any fractional time schedule . . . in any case you pay only for the power used and eliminate many worries. For details contact your nearest Utility Electric Power Company.

PETROLEUM ELECTRIC
POWER ASSOCIATION
BOX 35006, DALLAS 35, TEXAS

*A list of P.E.P.A. members will be furnished on request.*

TIGER ON THE SPOT IN THE OIL FIELDS

This is the line with the PETROFIBER Core that outperforms and outlasts any other type of core used in well-servicing lines. It will save money for you in every USS Tiger Brand Line you buy for this service.

This mark tells you a product is made of modern, dependable Steel.

# "USS Tiger Brand line with Petrofiber Core is the best yet for well-servicing"

"We've tried every line that came along for well-servicing and this Tiger Brand line with Petrofiber Core outlasted them all." These are the words of Mr. K. D. Cole and Mr. B. G. Spurgeon who operate seven well-servicing rigs around Wewoka, Oklahoma. Every well-servicing contractor has run up against the problem of shortened wire line life due to core deterioration caused by hole fluids such as acids, caustics, salt water and other elements in the well.

**Petrofiber cores are 100% resistant to all hole fluids.** They are made with synthetic fibers derived from a new group of petrochemicals: polypropylene by name. This material has superior qualities for cores of swabbing lines, sand lines, and drilling lines when used in well-servicing. The new Tiger Brand Petrofiber line can be stored indefinitely without rotting or aging of the core. It has no tendency to absorb corrosive hole fluids or chemicals.

**Provides best strand-supporting characteristics.** Petrofiber cores afford a more stable and more lasting support to the line's steel strands. Core flow or migration which can result in unbalancing the line has been eliminated.

**Withstands highest well temperatures or arctic cold.** Petrofiber cores have an extremely high softening point of almost 300°F. This permits continued operation at higher well temperatures than ever before possible. They also retain full toughness down to *minus* 80°F. They could be used in the Arctic Circle or in the desert without core damage.

**Gives longer money-saving service.** Wire lines made with Petrofiber cores withstand the most difficult well-servicing operations. They have been proven in the field and will outlast any line you've ever used. Send for our folder on Tiger Brand Lines with Petrofiber Cores. American Steel and Wire, Dept. 1159, 614 Superior Avenue, N.W., Cleveland 13, Ohio. USS, Tiger Brand and Petrofiber are registered trademarks.

**American Steel and Wire**
**Division of**
**United States Steel**

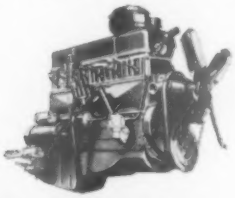
USS

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
United States Steel Export Company, Distributors Abroad

CHEVROLET

# HERE'S WHY IT'S A GOOD IDEA TO GET A CHEVY PICKUP:

Because Chevy's wide choice of models (there are 15 of 'em!) means you'll get the *right* pickup . . . because each is engineered to the highest standards . . . because Chevy's rugged, smooth-riding build lasts longer, costs you less to own and keeps your profits at peak levels. Chances are, whatever you consider most important, you'll find Chevrolet has thought of it first, and done most about it. Whether you get a handsome Fleetside or handy Stepside model (or possibly a Corvair 95 Rampside or Loadside or one of a half-dozen four-wheel-drives) you'll soon be convinced that buying a Chevy pickup was the best idea you ever had!



## ECONOMY

The Chevrolet slant on economy makes the most sense of all, with the tight-fisted 235-cubic-inch Thriftmaster 6 (standard) leading the way. It's the most experienced money-saver going, one that's powered more payloads than any other engine in the business. It's famous for its stingy way with a gallon of gas and also for its rock-ribbed durability. It keeps your Chevy at work, making money, instead of in the repair shop, costing. And if you prefer the extra snap of V8 power, there's the eager, efficient Trademaster V8, 160-horsepower strong and available at nominal extra cost in all conventional pickup models.

## CAPACITY

Chevy pickup bodies—6½, 8 or 9 feet long—are tops in cargo capacity and convenience, with a long list of bonus-built features to keep them working better and looking their best from delivery to trade-in. Both Fleetside and Stepside models feature select wood floors for better footing and quieter going, with steel skid strips to ease loading and unloading. Extra strong grain-tight tailgates with anti-rattle latches and support chains minimize bulk cargo leakage and offer firm support for extra-long loads. Fleetside body sidewalls are double-walled in the lower section, for extra rigidity and protection of exterior surfaces against dents caused by shifting cargo.

## PROFIT-★★★★★ PROTECTING RIDE

All of Chevrolet's 2-wheel-drive pickups feature years-ahead Independent Front Suspension design, with ride, roadability and ruggedness that are paying off for truckers everywhere. The reduction in driving effort and fatigue that makes a bigger day's work come easy is just one part of the three-way Chevy payoff. The same shock-cushioning action protects your cargo against damage en route, and also protects the truck itself against the bumps that can batter the life out of cab, body and chassis components. Sounds too good? . . . sample it for yourself at your Chevy dealer's, soon! . . . Chevrolet Division of General Motors, Detroit 2, Mich.

## 1961 CHEVROLET STURDI-BILT TRUCKS

CHEVROLET

*Franks Explorer....*

# NOW FULLY FIELD PROVEN!

When the Franks Explorer was first introduced to the well servicing industry some two years ago it received immediate acceptance from many contractors. Others assumed a wait-and-see attitude. Why? Because the Explorer was a totally new concept — a self-propelled unit primarily designed as a servicing and workover rig, and mounted on a rugged carrier for secondarily designed to over the road travel. Here was the promise of new speed, more horsepower, greater flexibility. The "wait-and-see" groups settled back to watch.

## AND WHAT DID THEY SEE?

Within two short years they saw the Franks Explorer outsell all competition. They saw themselves joining that first group of contractors who accepted the Explorer immediately — who knew Franks' reputation for building good equipment and for delivering what is promised.

If you're still from Missouri, ask the man who owns a Franks' Explorer. Or, better still, call your Franks' representative for all the details.

WELL SERVICING AND DRILLING UNITS

FRANKS

PAMPA, TEXAS

CABOT

CABOT CORPORATION
MACHINERY DIVISION

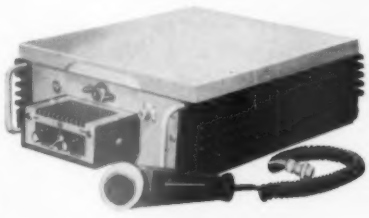
*Worth more when you BUY 'EM . . . Worth more when you TRADE 'EM*

## RCA "LD" 2-way radio has the guts to stand up to the toughest jobs!

There are rugged places where men, trucks and 2-way radios have to go, and each has to be a proven, reliable performer. In 2-way radio, this means quality must be built-in to take the gaff—quality such as only the leader in radio and electronics can offer—in the new RCA "LD" (Low battery Drain). Quality and price are combined in this dependable RCA equipment to give you the very best performance at the lowest cost. Use it on the roughest roads—Security Sealed Circuits are your assurance it can take it. Leave the radio on when your vehicle engine is turned off—battery drain is negligible—transistors are used in circuits where they have been proven to be most dependable.

It took experience and daring to bring you today's RCA 2-Way Radios. It meant discarding preconceived notions about circuits and redesigning with transistors in key places for reliability with economy. And it involved engineering a host of other advanced features to assure fine message intelligibility, and long component life at moderate cost.

Your RCA Communications Specialist will be glad to show you why the "LD", dollar for dollar, feature for feature, is today's greatest 2-way radio value. Or send coupon for further facts.



RCA

The Most Trusted Name in Radio

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☐ Please send me FREE literature on the new RCA Transistorized Mobile Radio.

☐ Have RCA Communications Specialist contact me and explain why this is today's best value in 2-way radio.

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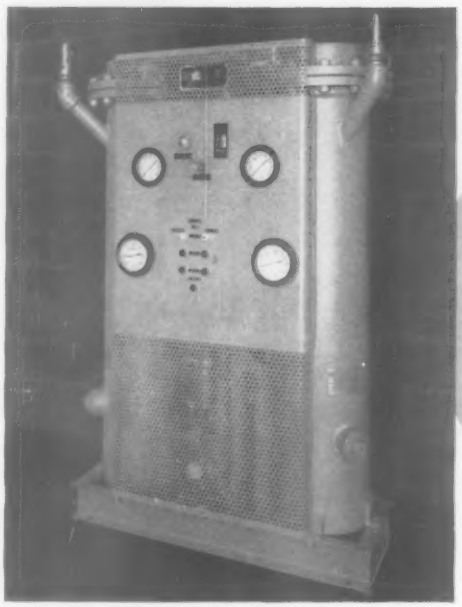
# KEMP ORIAD DESICCANT DRYERS

*stop moisture best, cost less 3 ways!*

**1 Complete reactivation**
An exclusive 3-zone embedded-heater design gives every KEMP ORIAD DESICCANT DRYER unmatched extra-drying power. Reactivation is always complete and uniform in *any* drying process of air, gases or liquids, assuring maximum desiccant capacity—minimum dew-point performance.

**2 Perfect temperature control** Heat input is conserved by thermostatic control . . . ideal temperatures are maintained for the highest operating efficiency at the lowest operating costs. An alarm system guards the entire network.

**3 Full automatic operation** A simple setting of the program timer, and everything is automatically regulated. Drying results with the least pressure loss, lowest operation and maintenance cost. For further details, write for Bulletin D-103 . . . or call your local Kemp Man listed in the Chemical Engineering Catalog.



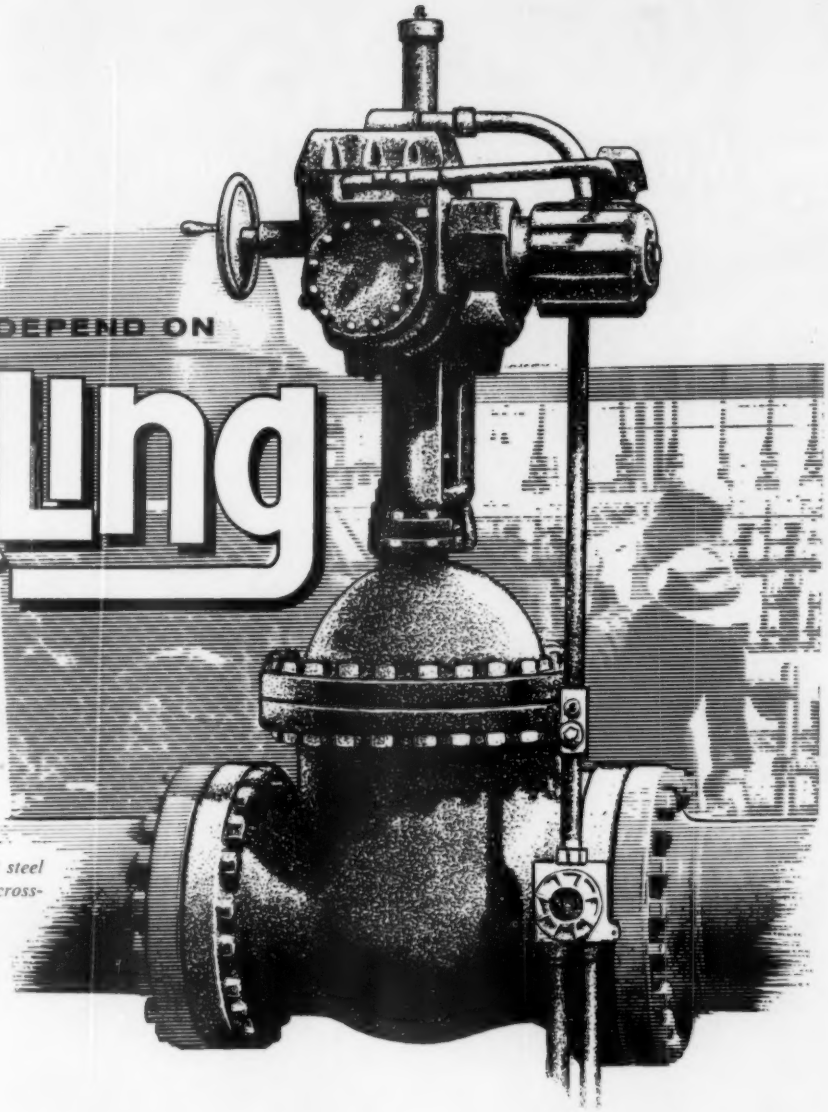
*It always pays to come to*

**KEMP OF BALTIMORE**

**THE C. M. KEMP MANUFACTURING CO.**
405 E. Oliver Street • Baltimore 2, Maryland

YOU CAN DEPEND ON

# Darling



*Motor-operated, 18" Darling cast steel gate valve installed on a major cross-country products line.*

Darling pipeline gate valves have established an impressive record in reducing down-time and maintenance costs to a minimum.

The fully revolving double disc parallel seat and wedge principle makes Darling cast steel gate valves outstanding in pipeline service. This simple, yet unique, design minimizes friction, avoids concentrations of wear and compensates for valve seat distortion. *You can depend on Darling* gate valves to close tight even under severe line stresses and extreme temperature changes. They open fully to permit free passage of line scrapers.

Write for descriptive bulletin or outline your service needs and ask for our recommendations. No obligation, of course.

## DARLING VALVE & MANUFACTURING CO.

**Williamsport 1, Pa.**

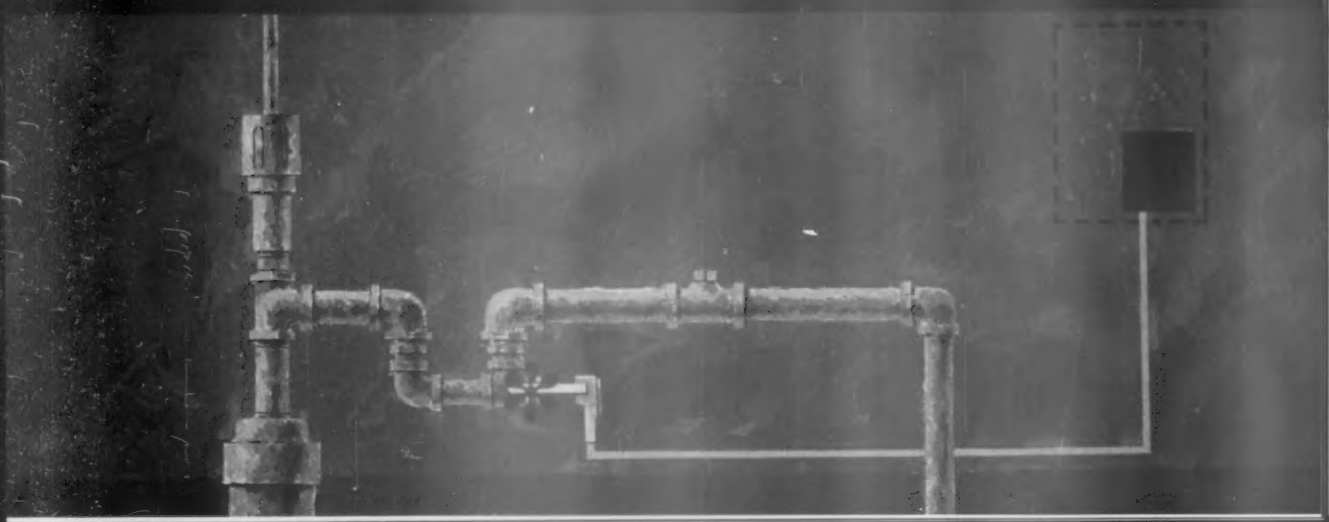
*Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ontario, Canada*
*Vannes Darling-France, 23 rue du Commandant Mouchotte, St. Mandé, France*

TRADE DARLING MARK

**GATE • BUTTERFLY • CHECK • SPECIAL VALVES • FIRE HYDRANTS**

# *New oil well control development from Cutler-Hammer*

The Cutler-Hammer thermistor detects pump off, then signals transistorized relay which shuts off pump.



# At last! An automatic pump off control that ends dry pumping!

- *Cutler-Hammer's exclusive pump off control for oil wells eliminates severe wear from dry pumping*
- *Cuts pumping time up to 25%, yet maintains maximum oil production . . . saves electricity, too*
- *Field tested for 2½ years . . . proved to lower oil lifting costs*

Now one of the biggest problems in oil well production is solved.

The new Cutler-Hammer Automatic Pump Off Control takes the guesswork out of figuring pump off time.

An ingenious sensing probe, (an electrically self-heated thermistor) measures fluid flow electrically. When the well pumps off, the thermistor signals the transistorized relay which in turn shuts off the pump. *Fluid flow* is the gauge—no other factors influence pump off.

You get maximum oil production without undue wear and maintenance. Even under rapidly changing well characteristics the pump off control matches pumping schedules to well production—a real aid to pumpers.

By preventing just one pump overhaul you save enough to pay for a half dozen or more Cutler-Hammer pump off controls. You can't afford to be without them. This unique control is easily installed with any size pump. Better get Pub. LO-16—E275 now for full details.

**What's new?** This new, *better* product is a typical example of what you can expect from the new Cutler-Hammer. We've added new plants, new engineering talent, even a new trademark that symbolizes our new capabilities for the demanding decade ahead. Find out more about our new problem-solving capabilities soon.

*WHAT'S NEW? ASK...*

## CUTLER-HAMMER

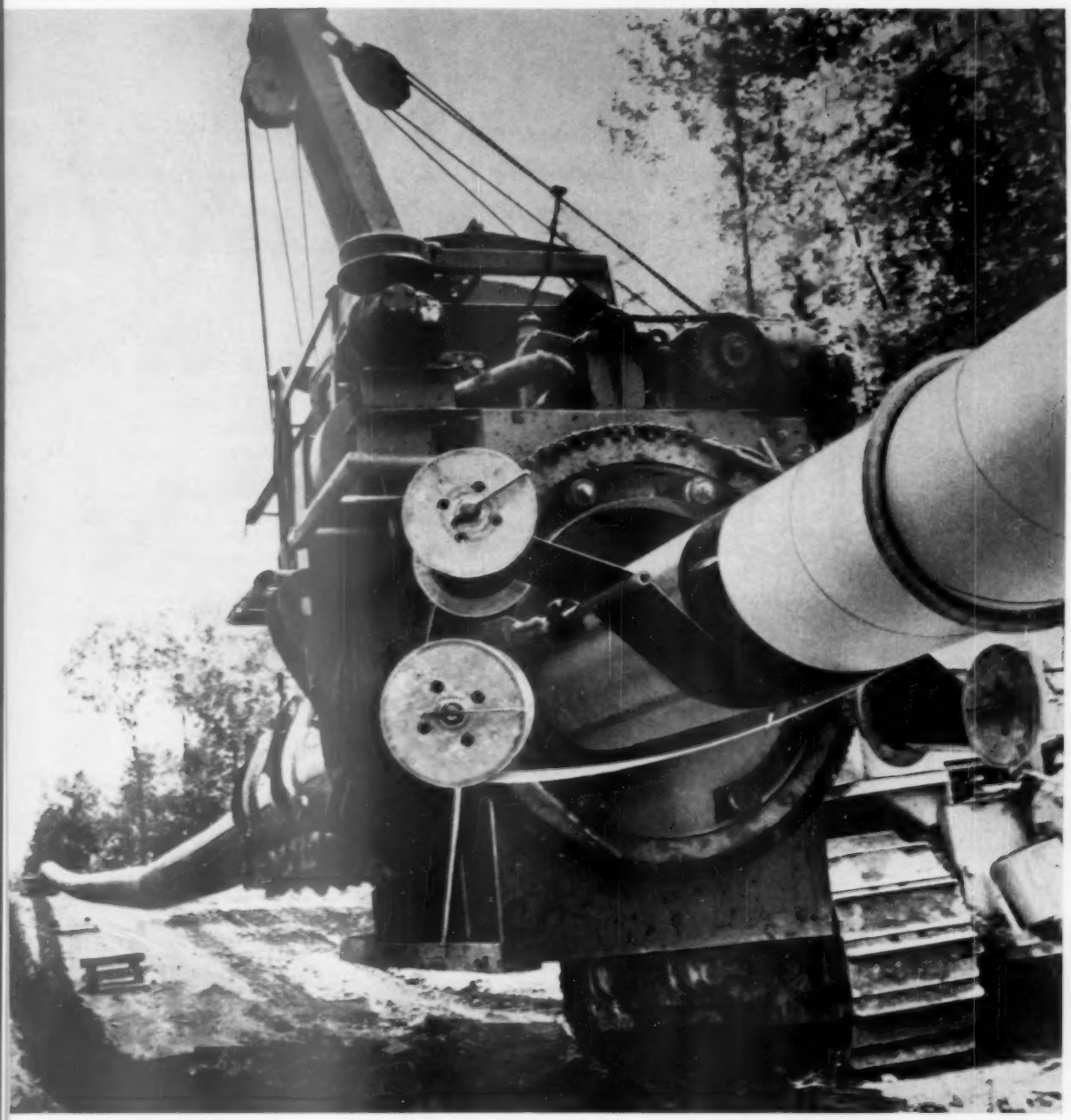
Cutler-Hammer, Inc., Milwaukee, Wis. • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C.A. • Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer, Mexicana, S.A.

# Repeat purchases–best endorsement for Polyken

1956 INSTALLATION,
Chester to Bellwood, Va.,
4.5 miles of 6" pipe
1960 INSTALLATION,
Boswell's Tavern to Gum Spring, Va.,
26.7 miles of 18" pipe

## Commonwealth Natural Gas makes repeated use of

Officials of Commonwealth Natural Gas Corporation of Richmond, Va., were impressed in 1956 with the many advantages of Polyken coating protection. With confidence based on the cathodic protection needs of their Polyken tape-coated 1956 Bellwood line (*inset photo*), they put this coating to work two years later on their Chester to Petersburg, Va., line (12 miles of 18" pipe). In 1959, *more* Polyken coating . . . Waverly to Ivor, Va., (15.8 miles of 12" pipe). And most



# Polyken® coating on strength of past performance

recently, the line from Boswell's Tavern to Gum Spring (*main illustration*).

It stands to reason that repeated use is founded on first-hand satisfaction and trust. Many discriminating companies make Polyken protection their standard specification because of its dependable performance. Get full details on Polyken performance and economy from your representative, or write Polyken Sales Division, 309 West Jackson Boulevard, Chicago 6, Ill.

**Polyken**

EXPERIENCED IN PROTECTIVE COATINGS

THE KENDALL COMPANY
Polyken Sales Division

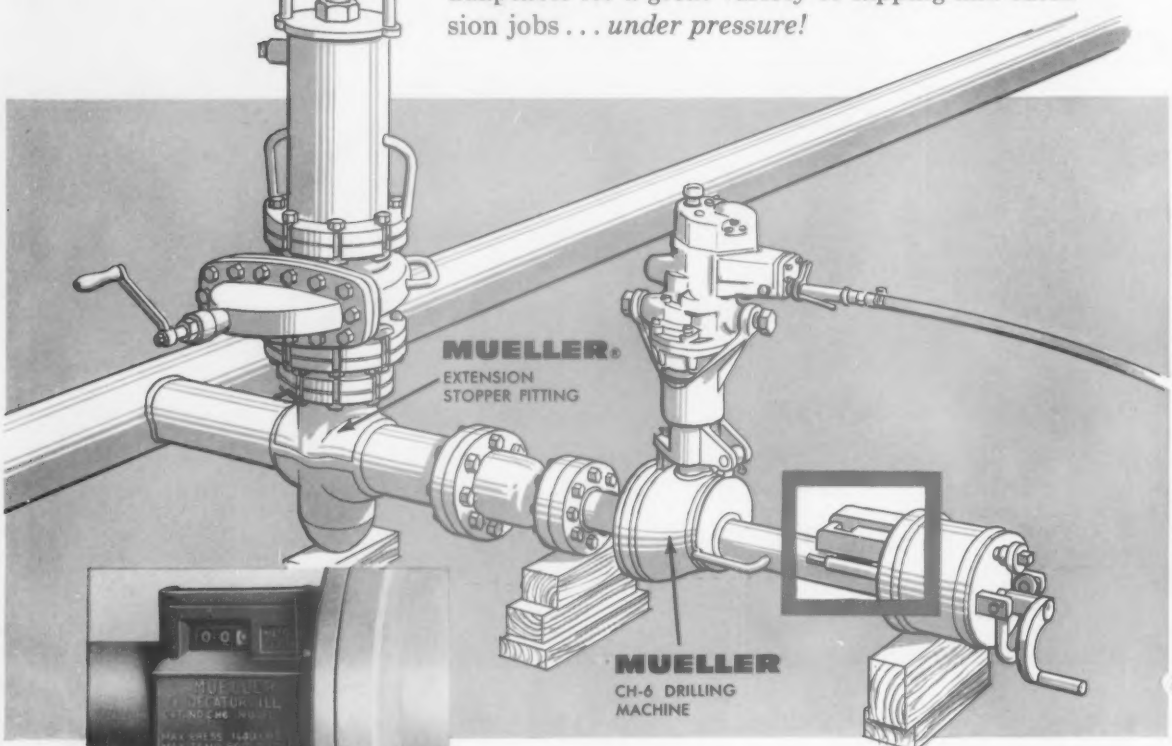
*make fast,*
*high-pressure cuts*

# *automatically!*

High pressure lateral connections are quickly completed to any line or tank with the Mueller NO-BLO® CH-6 Machine.

Automatic cuts, under pressure, are completed quickly and safely.

The versatility of the CH-6 Machine makes it adaptable for a great variety of tapping and extension jobs . . . *under pressure!*



## *set it and forget it!*

Automatic power cutting using an air motor or gasoline engine power unit *greatly reduces total on-the-job time* . . . frees operator for other work around the job-site. Feed and position indicators show depth of cut and boring bar position at all times. When travel limit is reached, feed automatically disengages to prevent overtravel.

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NO-BLO®

# Du Pont Petroleum Chemicals News

Number 108 in a series of bulletins for the Petroleum Industry — MAY • JUNE 1961


## WHAT'S PLAYING AT THE MOVIES TONIGHT?

Chances are, if it hasn't already arrived at your local movie house or drive-in theater, the oil industry's new travel development movie will soon appear in your marketing area.

It's called "Down the Road." It's a full-color, CinemaScope featurette narrated by Lowell Thomas and sponsored by the Du Pont Petroleum Chemicals Division to stimulate American families to greater interest in the grandeur and heritage of this nation. International distribution is being made by 20th Century-Fox.

### *Highway Adventure*

For ten minutes, the screen becomes a thrilling coast-to-coast highway adventure – cruising through the Canadian Rockies, the sands of Daytona, the Painted Desert, a little village in New England . . . visiting great cities like New York and New Orleans . . . watching parades and football games . . . sampling the riches of America's culture and history in a breathtaking series of flashing scenes.

All this is made possible by the family automobile, the magic carpet of the American public. This Du Pont film also includes scenes showing the importance of the service

*Continued on next page*

A scene from the motion picture, "Down the Road." Film encourages families to visit the scenic and historic beauties of the American continent.

## Du Pont RP-2 controls pipeline corrosion for $0.0011 per barrel

Every scraper run through a product pipeline costs you too much.

Every hour lost in pipeline throughput, every filter replacement, every barrel of product made hazy by pipeline rust—*they all cost you too much.*

There is an inexpensive way to cut these losses. As little as 1 to 3 pounds of Du Pont RP-2 corrosion inhibitor, added to every 1,000 barrels of distillate, protects against pipeline rusting.

*Example:* In a recent test, metal strips were inserted in a pipeline at various intervals up to 750 miles from the refinery. With only 2 pounds of RP-2 per 1,000 barrels of gasoline ($0.0011 per barrel), corrosion control was satisfactory throughout the system. Many of the strips were entirely rust free even after 30 days.

### *Marketing Advantages, Too*

What's more, this is the same RP-2 that (at slightly higher dosages) you can use to add several marketing advantages to your product – anti-stalling, carburetor-cleaning and surface ignition control.

RP-2 is effective in automotive gasolines, fuel and diesel oils, aviation gasolines, jet fuels and other petroleum products subject to pipeline transportation.

Details on this low-cost anti-corrosion protection are available from your Du Pont Petroleum Chemicals representative.

ADVERTISEMENT – Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER ▶

*Continued – Movies*

station in keeping the family automobile running properly.

### *You Can Tie In*

If you are interested in tying in your own travel promotion with this 20th Century-Fox film (as many oil companies already have), your Du Pont representative will gladly give you full information on show dates in your market areas.

Prints of a second Du Pont film are available for group showings and for television use. It is called "Highway Holiday", and is also available through your Du Pont Petroleum Chemicals representative.

**EASTERN REGION TECHNICAL MANAGER**

**GEORGE A. FINN** is Technical Manager of our Eastern Region, headquartered in New York City.

Dr. Finn has been with Du Pont's Petroleum Chemicals Division since June of 1953. Prior to his present position, he was assistant to the Technical Manager in the Eastern Region. Earlier, he was Manager of our Gulf Coast Laboratory in Houston, Texas.

In the past eight years, he has had extensive experience in working with petroleum products and additives in the division's Gulf Coast and Eastern Laboratories and in the main Petroleum Laboratory located at Carney's Point, N. J.

Currently, Dr. Finn is active in helping a number of refineries and gasoline marketers to evaluate the various antiknocks now available, and to decide which are most economically feasible to provide desired octane numbers. Having experience with all three major antiknocks, TEL, TML and TETRAMIX* antiknock compound, Dr. Finn can give impartial help on all antiknocks.

Dr. Finn is well qualified to help oil refiners. He holds a B. S. degree from Holy Cross, a Ph.D. from Notre Dame, and has considerable practical experience in petroleum technology.

*Trademark

One man can easily carry an armful of lengths of "Delrin" acetal resin pipe. The 2" pipe in 100 mil thickness, weighs only one-half pound to the foot. The pipe comes in 20-foot lengths, can be field-cut easily to special lengths.

# New lightweight pipe now helps oil men save money

"What this industry needs," it has been said, "is a corrosion-resistant, lightweight pipe for flow lines, gathering lines, water flood lines and salt water disposal lines."

Pipe dream? It was, until the recent arrival of a new kind of plastic pipe from Du Pont. It's "Delrin" Acetal Resin Pipe, the first and only plastic pipe yet made which can withstand continuous pressure surging, even in the presence of oil.

"Delrin" pipe is unique in that it actually grows stronger, under continuous surging to a peak pressure, than when subjected to the same peak pressure under steady, non-surging conditions.

### *Corrosion Resistance*

This pipe resists corrosion, of course – inside and out. It is strong in the presence of oil even at high temperatures. It is tough. It resists solvents. It resists weather and withstands underground burial.

Even sour crude oil and salt water have no corrosive effect on "Delrin" pipe.

Yet, it is lightweight and can be quickly installed in the field. Integral joints are made by a simple heat-fusion process, taking only about 25 seconds to complete – and the pipe can be operated at full pressure immediately afterward!

### *Other Savings*

Shipping, storage and handling of "Delrin" pipe mean savings for you. Extensive test installations at eight leading oil companies have helped to prove out these advantages. Results of those tests led to the recent commercial introduction of this pipe by the Du Pont Company.

If you would like further information on the economies of "Delrin" acetal resin pipe, please write to: Du Pont, Polychemicals Department, Wilmington 98, Delaware.

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In Canada–Du Pont of Canada Limited, Petroleum Chemicals, 85 Eglinton Ave. East, Toronto 12, Ontario .....HUdson 1-6461
OTHER COUNTRIES: Petroleum Chemicals Division, Export Sales, Wilmington 98, Delaware .....PRospect 4-5009

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REG. U.S. PAT. OFF.

**Better things for better living**
***. . . through Chemistry***

## Du Pont Lead Antiknock Compounds and other Petroleum Additives

◀ OVER

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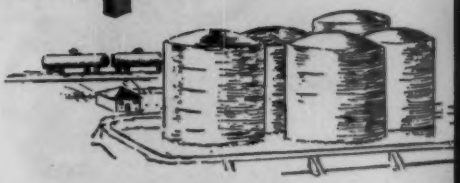
Printed in U.S.A.

NEW

# G-R KH-223 Tank Heaters



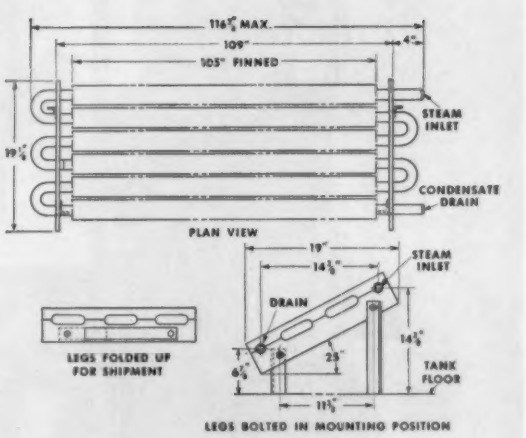
## STEEL TUBES, ALUMINUM FINS
## HIGH HEATING EFFICIENCY

**G-R** KH-223 Heaters have 223 sq. ft. of surface. They weigh only 165 lbs., can be *carried easily* over rough ground by two men, passed through a standard 20″API manhole and installed in new or existing tanks, either singly or in banks.

These heaters consist of two lengths of G-R aluminum finned steel pipes, each bent to form three passes, which are then welded together. This "one-weld" construction *eliminates the needless weight* and the additional welding associated with manifolds and headers, avoids any need of stress relieving, and assures *dependable, leak-proof operation.*

The finned tubes are supported in steel channels at each end permitting *free thermal expansion.* Four legs, that fold against the channel during shipment, bolt upright to hold the heater in sloping position, 6″ above the tank bottom, thus assuring complete submersion under all normal operating conditions.

The heavy duty helical *aluminum fins* with high co-efficient of conductivity—much higher than steel—assure greater heating capacity and create a thermal flow within the tank that avoids stratification.

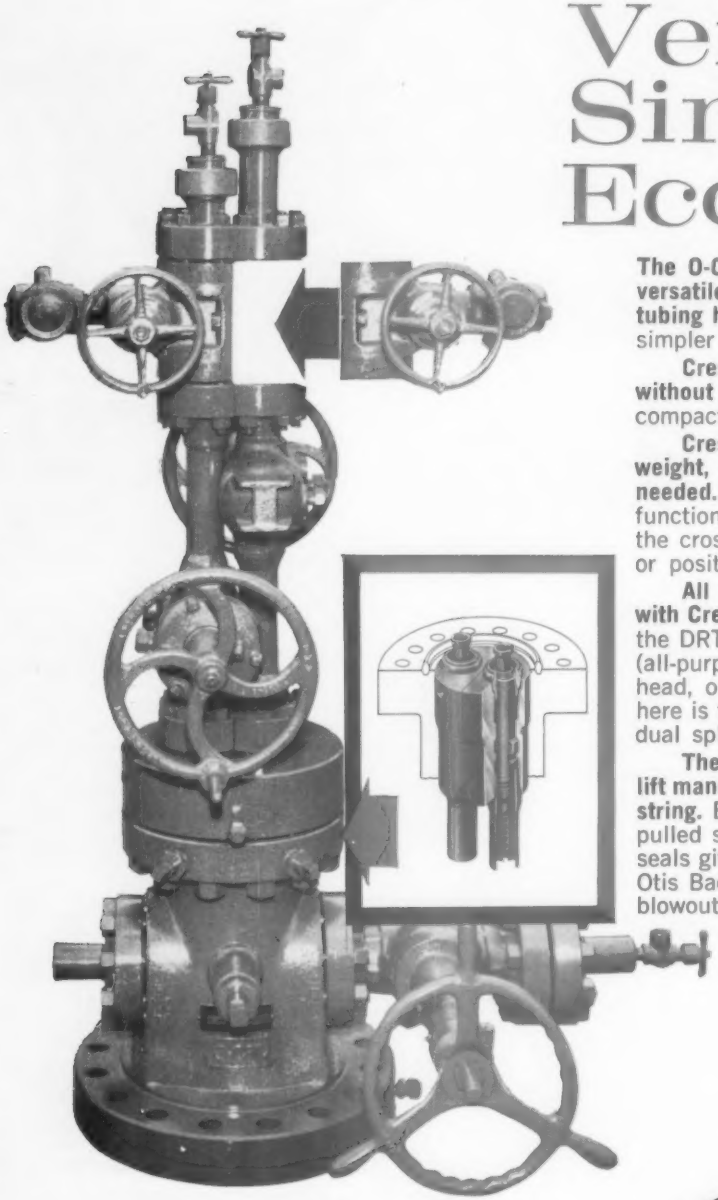



***Write for Bulletin No. 1623 today! It gives full details, and COMPLETE RATING DATA for all sizes of tanks and duties.***

**Griscom-Russell**

**THE GRISCOM-RUSSELL COMPANY**
221 Wetmore Ave. Massillon, Ohio Telephone TE 2-8751
Engineering and Sales Representatives in the Principal Cities

# O·C·T Crescent Flange Trees GIVE YOU Versatility Simplicity Economy



**The O-C-T Crescent Flange Tree combines versatile Crescent Flow Controls with O-C-T dual tubing heads** to make dual completions simpler and more economical than ever.

**Crescent Flanges let you remove either valve without disturbing the other.** They are more compact and more economical than block valves.

**Crescent Flow Controls reduce cost, weight, and the number of connections needed.** They combine in one-piece units all functions of a single-wing tree, replacing the cross or tee, wing valve, and adjustable or positive choke.

**All O-C-T dual tubing heads can be used with Crescent Flange Trees.** These heads include the DRT (dual tension head), the TC (all-purpose head), the tubingless completion head, or the U-60 (universal head). Illustrated here is the U-60 tubing head with the U-60 dual split hanger.

**The dual split hanger permits running gas lift mandrels or packer receptacles on either string.** Each semicircular hanger can be run or pulled separately. Compression-type hanger seals give automatic annulus packoff, and O-C-T Otis Back Pressure Valves give complete blowout control after tubing has been landed.

**These features provide compact, low-cost, dual-completion well heads that permit producing several zones to depletion without major well-head changes.**

See your O-C-T representative for further information, or write directly to O-C-T.

*where progress is a daily practice*

**O·C·T**

**OIL CENTER TOOL CO.**

SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

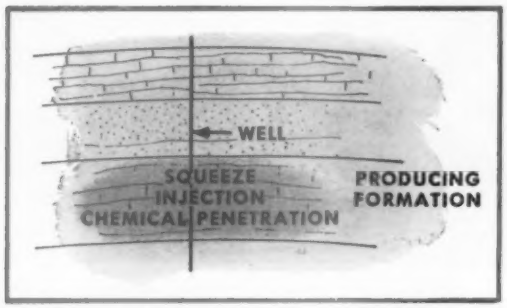
Address Export Inquiries for All Countries to P. O. Box 3091, Houston, Texas.

# Visco Squeeze Treatment Chemicals Designed to Fit Varying Well Conditions

## Corrosion Control Lasts, Costs Less with New Visco Formulas, Methods

Squeeze treatment in producing wells continues to grow in importance as an economical, long-term method of obtaining effective corrosion control. It is simply the pressure injection of corrosion inhibitor chemical into the producing formation, from which it is released in approximate proportion to produced fluid volume over a period of time—anywhere from two to sixteen months.

Visco has found squeeze treating of sufficient interest to producers to justify development of specialized chemicals and techniques to permit most effective use of the method.



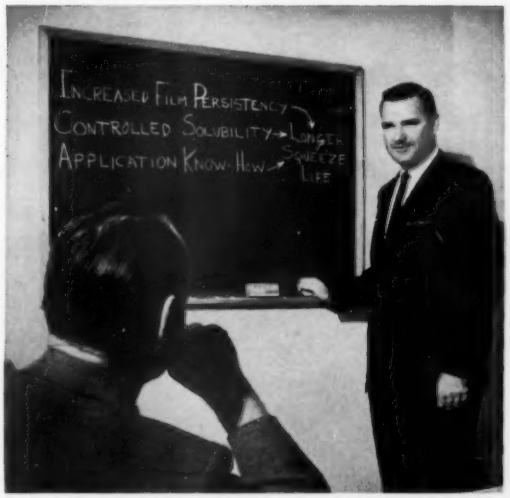

**Squeeze technique forces chemical corrosion inhibitor into formation around well bottom. Chemical is carried back with produced fluid. The excellent film persistency of Visco squeeze treating chemicals assures long-lasting, low-cost well protection.**

### Effects of Formation

Producing formation composition, porosity permeability and position can have an important bearing on the success of squeeze treatment corrosion control . . . They are important considerations in the development of special Visco formulas for this purpose.

### Determining Chemical Type

As with any operation affecting producing formations, experience is the most dependable guide. Chances are great that the conditions you have in your area have been closely paralleled by other Visco squeeze treating experience. Further, Visco Formulas such as




**Visco's P. H. Mallette, Product Manager for Corrosion Control Chemicals, discusses factors considered important in assuring effective squeeze treatment.**

new 939, 956, and 990, were developed to broaden the effectiveness of corrosion control with squeeze treatment, and so are a big help in pinpointing the best chemical and method to apply to specific well characteristics.

### Field Experience

Squeeze treating can offer some substantial cost and time advantages for effective corrosion control in many types of producing wells . . . BUT, probably more than any other treating method, squeeze treatment demands skill and experience, as well as effective chemicals, to assure success. No one is better equipped than Visco . . . *we* firmly believe no one else can do as well for you.

### Help, Now

Visco action toward being useful in your activities is as close as your phone—and nearly as quick as picking it up. Your move.

**VISCO PRODUCTS COMPANY**
Incorporated
*A subsidiary of Nalco Chemical Company*
**1020 Holcombe Boulevard** **Houston 25, Texas**

*Deutsche Nalco-Chemie, G.m.b.H., Frankfort, Germany*
*Nalco Italiana, S.p.A., Rome, Italy*
*Nalco de Mexico, S.A. de C.V., Mexico, D.F. Mexico*
*Nalco de Venezuela, C.A., Caracas, Venezuela*

Visco® . . . *Serving the Oil Industry through Practical Applied Science*

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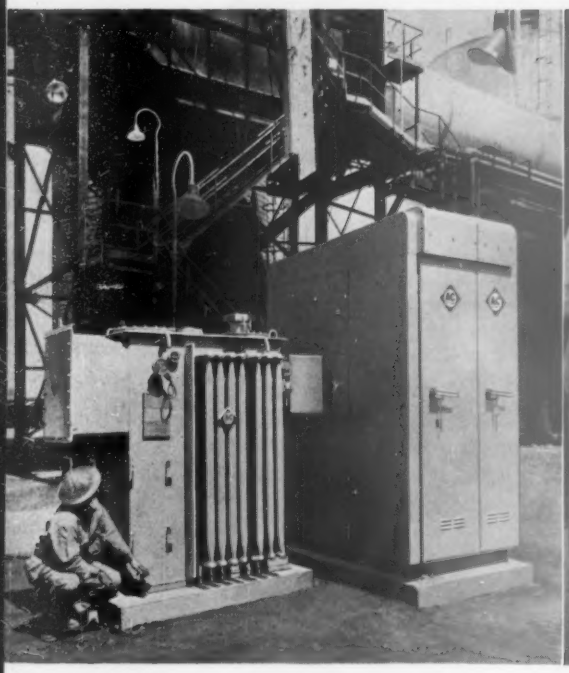
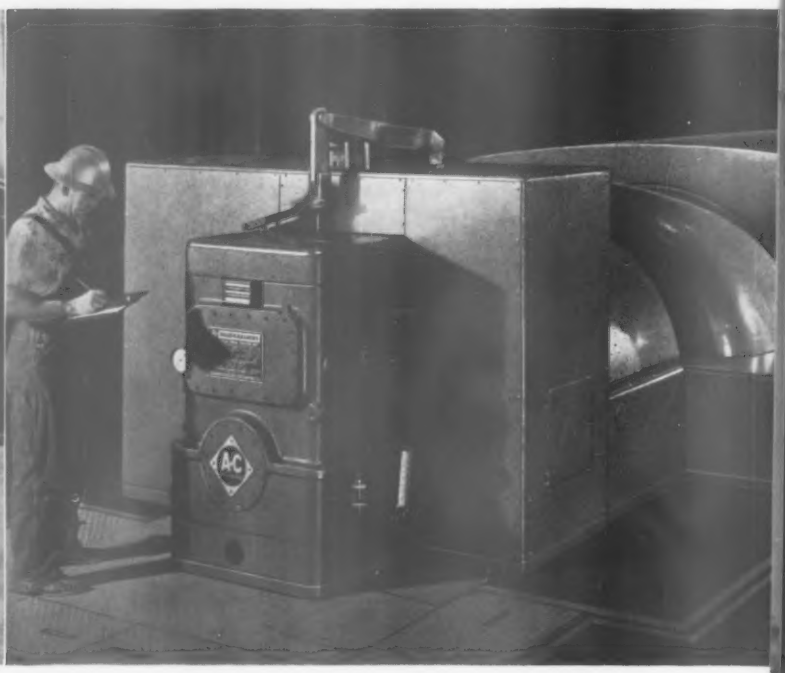
# ideas and news:





**Unit substations are "packaged" for lower costs:** Allis-Chalmers packaged unit substations reduce your engineering, planning and purchasing time—cut installation and maintenance costs, too. Located close to the load center, they provide reduced power losses, better regulation, flexibility for expansion. Oil-filled, CHLOREXTOL liquid-filled and sealed dry-type transformers are available.

**By-product power from process steam:** Steam is used twice in this ethane cracking plant. It enters the 6250-kw WA-Series steam turbine-generator units at 625 psig. Steam at 65 psig is automatically extracted for use as process steam in the cracking operation. An unusually simplified control and hydraulic valve-actuating amplification system minimizes maintenance and improves performance of these units. Allis-Chalmers complete line of turbine-generators includes condensing and non-condensing types in ratings of 2000 kw and larger.

## Which of these productive ideas could be working for you?

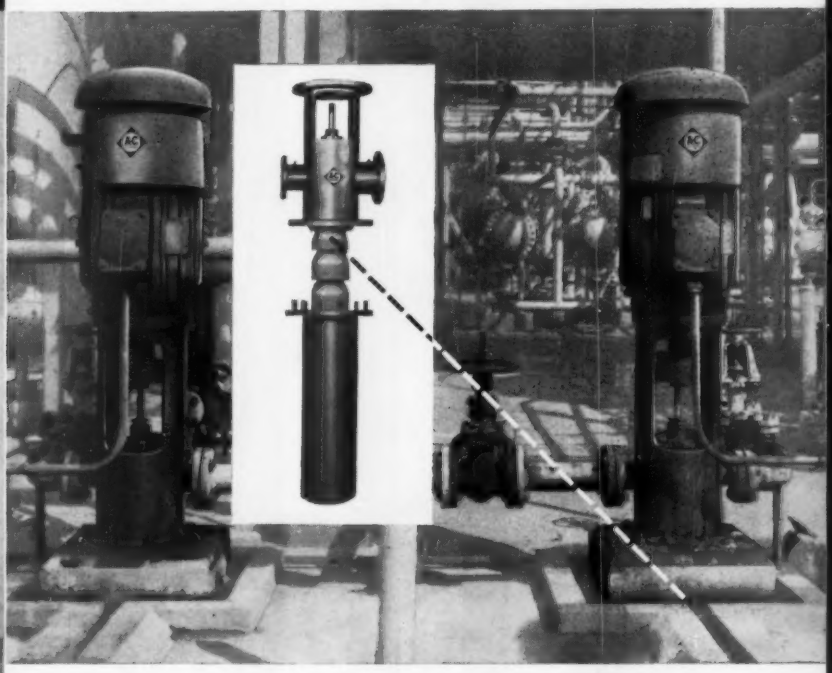
Motor controls that are safe in hazardous locations. Open motors that "thrive" outdoors. Efficient pumps for volatile liquids. These examples demonstrate the extra value that is standard with A-C ...the greater efficiency and the added productivity which are yours when you buy A-C products, systems and services. Call your Allis-Chalmers representative for details on A-C "worth-more" features. Or write Allis-Chalmers, Milwaukee 1, Wisconsin

A-1476

*Chlorextol, Unitank, Super-Seal and Poxeal are Allis-Chalmers trademarks.*

**For your hazardous and semi-hazardous locations:** A-C offers the most complete line of modern oil-immersed 2 to 5-kv motor controllers available. Units are available for any indoor or outdoor Class 1, Group D, Div. 1 or 2 application. High interrupting capacity fused units are also available for Div. 2. Unrestricted access to contactors and relay equipment simplifies inspection and maintenance. Contactors are rated 400-amp, 50-mva interrupting capacity for heavy-duty performance.

**Short lesson on pumping volatile liquids:** Use UNITANK pumps. These vertical turbine pumps are often the solution to NPSH pumping problems. Mounting of the impellers and bowl assemblies within a suction tank assures that impellers are always submerged . . . prevents fluids from vaporizing. Total dynamic heads from 20 to 400-plus feet are available, capacities from 20 to 3500 gpm.



**Open motor's at home on the range:** This SUPER-SEAL open motor fights off prairie dust (and rainstorms, too), thanks to remarkable POXEAL insulation. This Allis-Chalmers development enables open motors to resist dust, moisture, abrasives and contaminants. And the open design of SUPER-SEAL motors gives a higher service factor than TEFC types.

**ALLIS-CHALMERS PRODUCTS FOR THE PETROLEUM INDUSTRY:** Look to Allis-Chalmers for controls, rectifiers, switchgear, transformers, capacitors, circuit breakers, industrial systems, motors, pumps, compressors, valves, engine-generators, water conditioning equipment, thermal, hydro and atomic electrical generating equipment, earth moving equipment, tractors, lift trucks.

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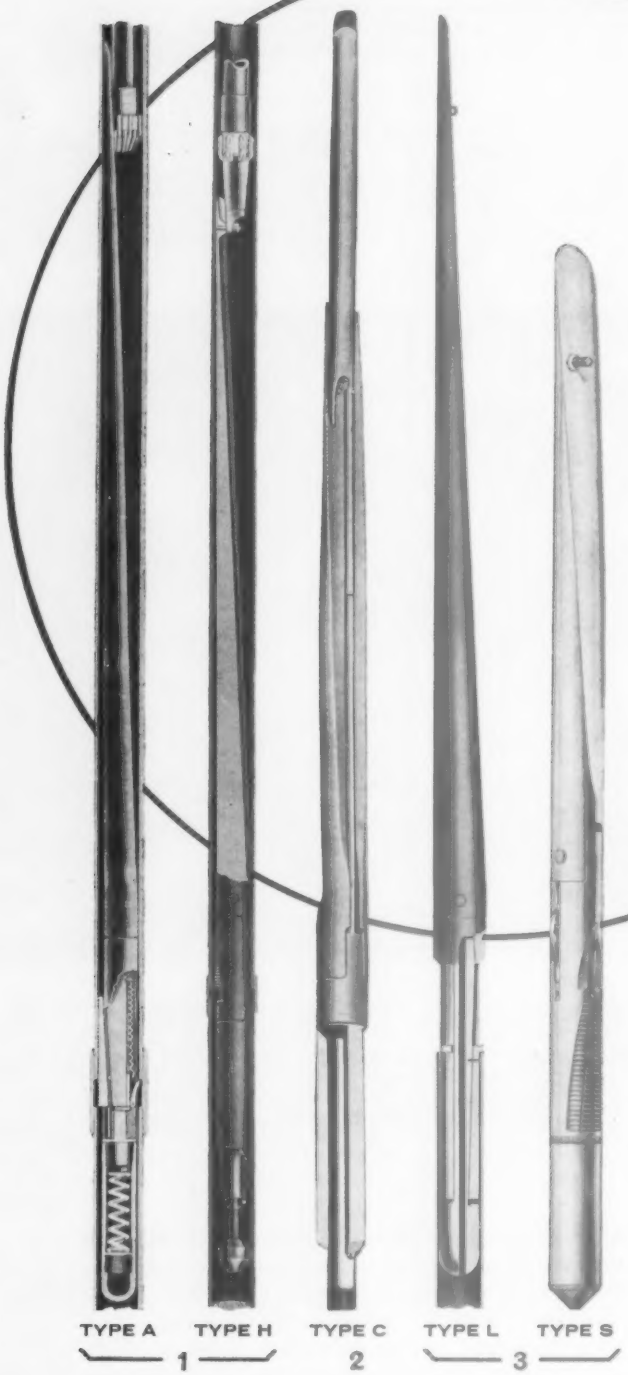
# THE ONLY COMPLETE LINE of WHIPSTOCKS




**Bowen engineering has developed and perfected whipstocks for EVERY well deflection problem.**

Any time you need to establish a new drilling course —
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to straighten crooked hole
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Bowen has the exact whipstock to fit your needs.

All Bowen whipstocks are designed to provide the safest, most dependable, and simplest solution to well deflection; they are available for all casing sizes.

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**Types A and H** (Type H has pilot lug)
Trip can be set at any collar or on bottom

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# Sure it's a dual completion– But is it a dual producer?

Many dually-completed wells have "pay" zones that aren't producing—for want of a recompletion job. These are *pay* zones only in the sense that you have paid for the completion.

In such cases, recompleting with Sidewinder-Sidekicker is like throwing good money after *good*. It's the only safe way to redo the job without disturbing production below, the one way to activate "pay" zones that aren't paying.

The Welex Sidewinder is a remarkable gun. It runs through tubing as small as 2″ with standard seating nipples. It packs the maximum charge in a minimum of space. It is mechanically oriented and decentralized by the Welex Sidekicker. A retrievable gun carrier absorbs the shock of the detonation and returns *every bit* of debris to the surface. Nothing neater, safer or surer.

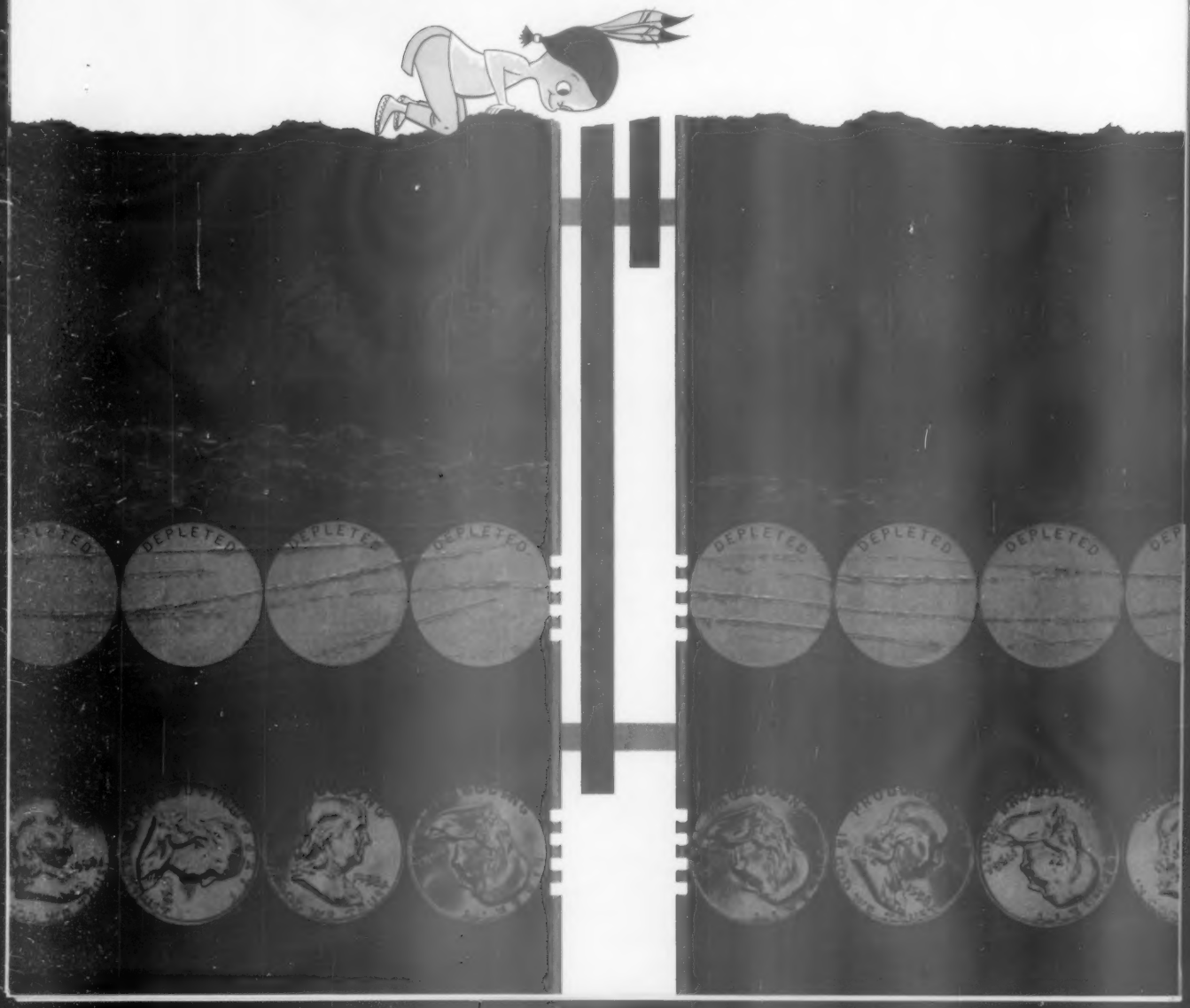
Don't be satisfied with producing a single zone when you've paid for a dual completion. Reperforating is now very simple and economical, thanks to the Sidewinder-Sidekicker. Remember, no derrick, no danger, no debris.

Call Welex on your next completion or workover. Welex has more years of perforating experience and a wider variety of wireline services than any other company.

**WELEX**

A Division of Halliburton Company

General Offices: 1728 Old Spanish Trail, Houston, Texas



another
# TRETOLITE SERVICE
report

**IN A PERIOD OF RISING PRODUCTION COSTS**

## KONTOL *prices are still at 1948 level!*

The Tretolite research staff constantly seeks ways to produce better KONTOL* Corrosion Inhibitor formulas for less money. This concern for *cost control* as well as *corrosion control* has kept the per gallon price of KONTOL at the 1948 level! Today, when costs of equipment, material, and wages are spiraling higher, it makes more sense than ever before to invest in a sound KONTOL corrosion control program.

*Ask the Man in the Red Car how it can be done.*

KF-60-3

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# THE UNMISTAKABLE LOOK OF PROGRESS

On rigs where concern is for increased crew efficiency and safety, at reduced costs, you'll find Web Wilson "Champion" elevators at work. Three unique reasons make these elevators the wise choice:

1. *Forward Swept Link Arms* permit easier handling in picking up and laying down pipe.
2. *The Slanted Hinge Pin* makes closing easier and under loaded conditions transfers a portion of the force from the latch to the hinge.
3. *Superior Balance* allows elevators to roll easily in the links. Better balance reduces the need for a balancing strap.

Add to these advantages the massive safety latch designed into the body so that the elevator will not be accidentally opened or damaged. Automatic latching results by the simultaneous action of latch and latch lock which close together.

*Write for brochure "A New Dimension in Elevators."*

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DIVISION OF JOY MANUFACTURING CO.

General Offices: Houston, Texas

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OUR 42d YEAR OF PROGRESS

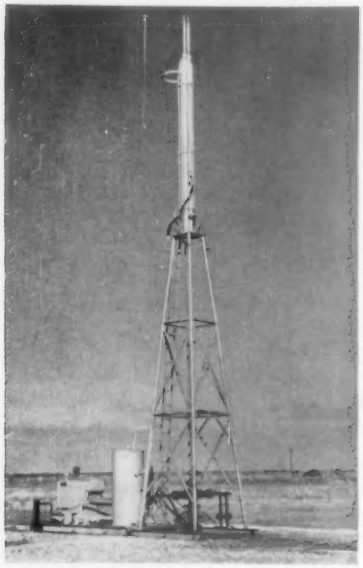
JOY

# New economy from hydraulic pumping

- EOT-Johnston Rod-Counterbalanced pumping units selected by Texas and Nebraska operators because of low initial cost; lower operating and maintenance costs.

Two oil operators put a sharp pencil to their production costs for dual-zone pumping wells and came to the conclusion there were real economies in favor of the new Rod-Counterbalanced hydraulic pumping units offered by Engineered Oil Tools, Inc. Though each of these operators had different pumping requirements, the final buying decision was based on initial equipment costs and projected operating and maintenance costs. The EOT Rod-Counterbalanced units won on both counts. Here are the reports:

**Operator #1:** This operator's Matagorda County, Texas well had two producing formations at approximately 7,500′. His required displacement rate was 100 B/D from each formation. Conventional beam units considered had a maximum stroke length of 86″ and required a pumping rate of 12-14 strokes per minute to handle the desired displacement. The new Engineered Oil Tools, Inc., Rod-Counterbalanced hydraulic pumping unit recommended for this application increased the stroke length to 144″ and slowed down the pumping rate to 6 strokes per minute to produce the same volume of fluid—at no increase in brake horsepower requirements! This operator saved $7,000 in capital outlay by purchasing the EOT unit rather than the beam unit suggested for this field installation. He reports the long, slow stroke of the EOT unit will save wear and tear on the rod strings and down-hole equipment and should substantially reduce maintenance costs, too.



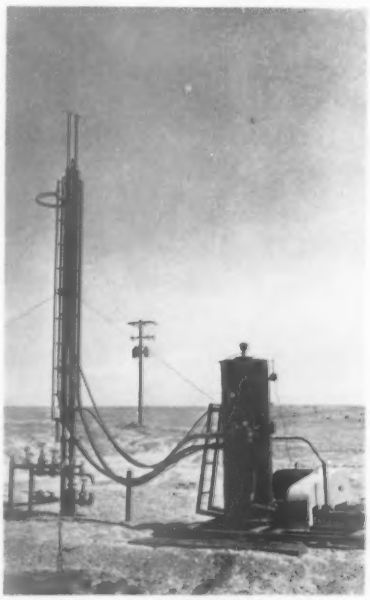
Matagorda County, Texas installation

**Operator #2:** A McCook, Nebraska operator had a different pumping problem to solve. His dual-zone well was not deep, only 3,500′, but production requirements were 250 B/D displacement. A 10 ft. stroke EOT Rod-Counterbalanced unit was suggested for the operator's application. When the operator compared the initial cost of the EOT unit against an alternate proposal, the EOT hydraulic unit won hands down. The performance of the pumping unit in the field has surpassed expectations. In fact, this operator has ordered three more EOT Rod-Counterbalanced units for immediate installation.

Other operators have reported substantial savings on pumping equipment with the EOT Rod-Counterbalanced unit. An Oklahoma operator had dual-zone, offset wells with producing zones at 9,000′ and 9,500′ in each well. The EOT Rod-Counterbalanced units recommended for this field application cut the pumping strokes in half, increased the stroke length nearly 100%, cut equipment costs by $13,000 over conventional beam units . . . and did the job with just one power unit!

**Simplicity of design:** The new EOT Rod-Counterbalanced hydraulic pumping unit was engineered to meet field operating and maintenance conditions. The unit requires no special start-up procedure; once the power package is started, the unit automatically pre-charges itself and begins operation. Once operating, the EOT unit times itself automatically and keeps the two cylinder units in phase automatically.

Maintenance is simple, too. A routine maintenance check of the oil level, oil filter and polished rod packing is all that is required. Should the unit need more than routine field servicing, Engineered Oil Tools, Inc. has spare parts in all major producing areas and competent service engineers available.



McCook, Nebraska installation

Investigate the economics of pumping your wells with an EOT Rod-Counterbalanced hydraulic pumping unit. Pump dual completions . . . offset wells up to 160 acre spacing with one power unit . . . and save up to 50% over other rod pumping methods.

EOT has a new fact-filled catalog on the Rod-Counterbalanced pumping unit. If you would like more information to save your company production dollars, write or call: Sales Department, Engineered Oil Tools, Inc., 1710 Burnett, Houston, Texas. Complete information will be sent you by return mail.

EOT

ENGINEERED OIL TOOLS, INC.

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*(Advertisement)*

# F-M TURBINE POT PUMPS

**...faster water-flooding payouts ...more pressure, less expense!**

Rugged F-M Turbine Pot Pumps are designed on the mechanically-simple "pot" principle with no reciprocating parts to cut downtime! They deliver more pressure—up to 3000 psi; capacities up to 102,000 Bbl/day. Centrifugal pump action provides completely surge-free flow; no suction pulsation dampeners needed. Our Turbine Pot Pumps run twenty four hours a day, cutting downtime and maintenance costs. F-M simplified design saves not only floor space expense, but permits smaller drives, lower power costs. Newly-designed seals and turbine blades make these F-M Pot Pumps the outstanding injection pumps on the market! Available in a wide range of sizes with a complete variety of heads and drives.

**FAIRBANKS MORSE PROVIDES A FULL LINE OF PUMPS FOR WATER FLOODING!**

**Deep Well Turbine Pumps**—Higher efficiencies that require smaller drives, less power . . . you save the difference in down price and operating dollars!

**Deep Well Submersible Pumps**—Quality-built down-in-the-well pumps simplify pumping from crooked wells, eliminate line shaft requirements.

Truly . . . the best you can buy!

**Centrifugal Pumps**—Look to Fairbanks Morse for the biggest, best line of centrifugals.

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Write us regarding your own individual installation needs. For information on **any** F-M pumps for water flooding, write to: **Fairbanks, Morse & Co.; Pump & Hydraulic Division; Kansas City, Kansas.**

**FAIRBANKS MORSE**

A MAJOR INDUSTRIAL COMPONENT OF

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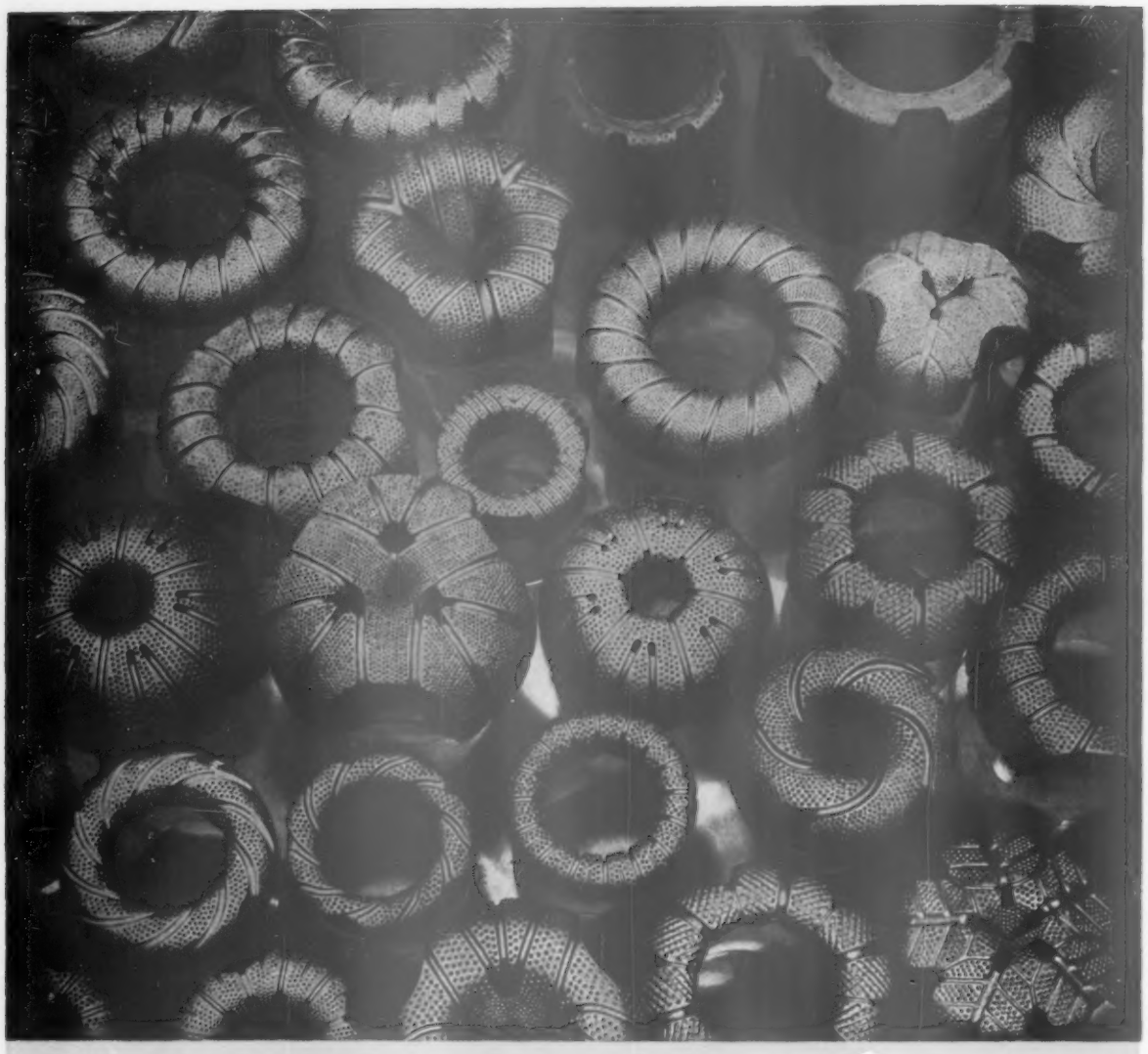

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. . . because Christensen "custom engineers" diamond bits to overcome particular problems. On that next drilling, coring, reaming, or fishing job, ask your nearest Christensen office about diamond bits designed for you

*"Less cost per foot"*

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# GROVE G-6 REGULAR PORT VALVE
# SIMPLE—COMPACT—VERSATILE

**For Manifolds, Headers, General Pipeline service**

Now the proven Grove Seal-"O"-Ring® design is ready in a compact regular port gate valve. Round opening (1) assures flow characteristics superior to plugs. Double-barrier seal gives positive metal-to-metal contact (2) backed up by protected o-rings (3) to keep gate clean, smooth for fast open/close. Non-rising stem (4) and "designed-in" compactness achieve overall height of only 14⅜". G-6 Regular Port gate valves, like all Grove valves, do not rely on sealing compounds for bubble-tight shut-off, thereby eliminating costs relative to this maintenance. Ready now in 2" ASA 900 and 1500.

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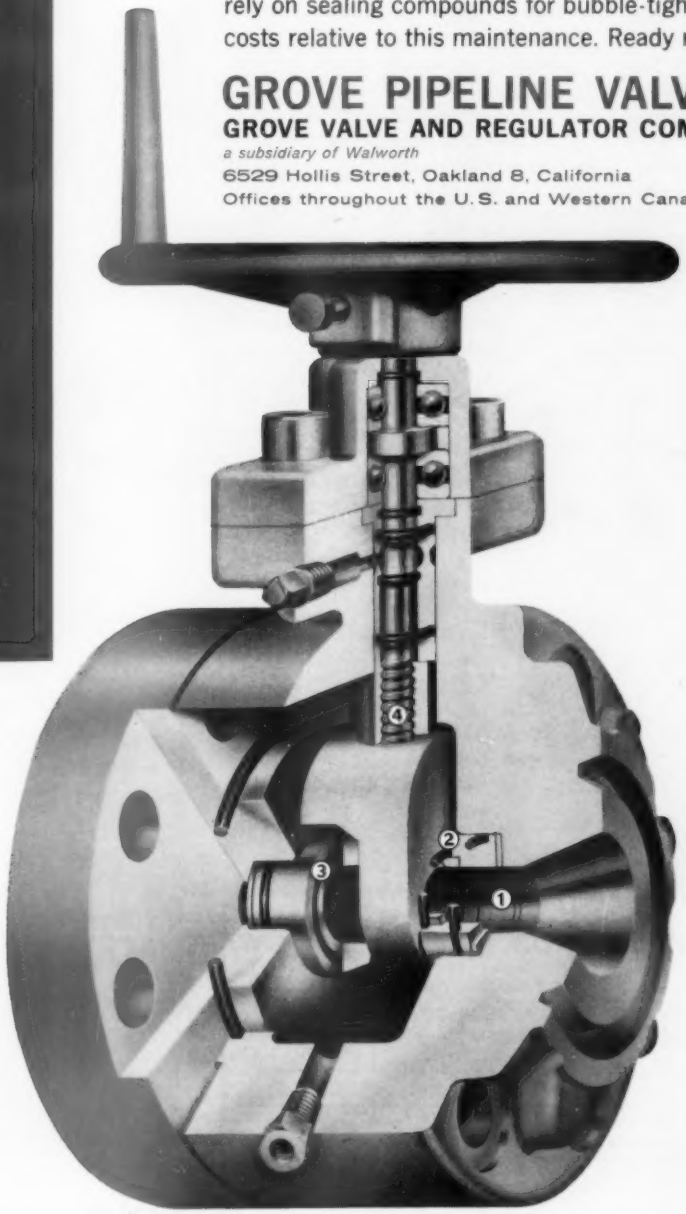


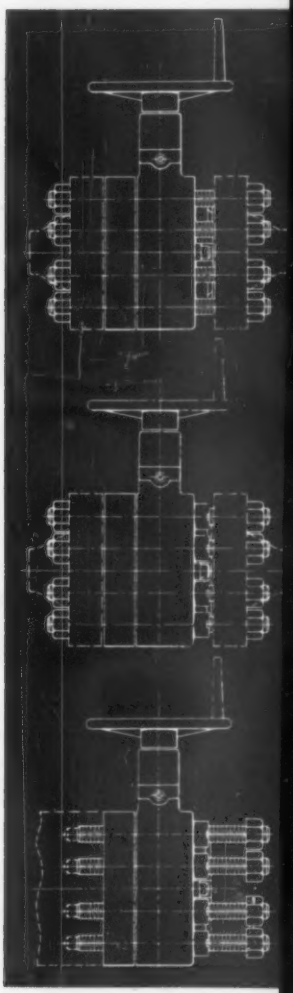

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*Engineering Progress Report*

FROM UNION CARBIDE CHEMICALS COMPANY

# REDUCE GAS-SWEETENING COSTS

## Two simple control tests increase plant efficiencies

Chemical analysis is the only quick and efficient method of gauging the operating efficiencies of plants that use monoethanolamine to sweeten natural gas. By proper interpretation of the simple, yet accurate tests, plants can be operated more efficiently and at some cost saving.

Quick titrations can give this information and enable the plant operator to keep safely below solution overloading, thus minimizing corrosion and solution contamination.

### TEST NO. 1—ACID GAS CONCENTRATION

The total acid gas content of both the rich and the regenerated lean solutions is determined by simple titration. By comparing the acid gas contents of these solutions, before and after regeneration, the regeneration efficiency and the net solution loading can be determined. This net solution loading (the amount of acid gas removed by the solution) should check with an acid gas material balance around the absorber.

An excess of acid gas in both the rich and lean solution indicates solution overloading or improper regeneration.

When the rich solution loading is high, while the lean solution loading is quite modest (here indicating good regeneration), one of three things may be at fault: (1) Insufficient scrubber fluid circulation; (2) Insufficient amine concentration; (3) either more gas is being processed than anticipated, or the acid gas content is higher than originally expected.

An excess of acid gas in the lean solution, when the rich solution is not overloaded, indicates improper regeneration or severe solution contamination.

### STEAM REQUIREMENTS FOR REGENERATION

Enough stripping vapor should be provided to the regeneration column to remove essentially all the acid gas from the rich solution before it enters the reboiler. Normal steam rates vary between 0.8 and 1.2 pounds of steam per gallon of amine solution circulated.

### FLUID CIRCULATION

In plants with all carbon steel equipment the amine solution circulation rate should be adequate to keep the net solution loading at or below 0.4 moles of total acid gas ($CO_2+H_2S$) per mole of monoethanolamine. Under these conditions, in the conventional plant, the rich solution will contain less than 0.5 moles of total acid gas per mole of amine; and the lean solution will contain 0.1 or less moles of total acid gas per mole of amine.

Contamination can be controlled by a side stream distillation unit that removes foreign materials and amine degradation products.

### TEST NO. 2—MONOETHANOLAMINE CONCENTRATION

By titrating a sample of the lean solution with standard HCl, to a pH of 4.5, the per cent of monoethanolamine free for acid gas absorbtion can be determined. This information allows for proper control of amine concentration and, therefore, proper setting of the circulation rate.

### OTHER TESTS

Union Carbide has for many years maintained laboratories for the examination of scrubber solutions, and for basic research in gas treating technology. These are two of many analytical tests described in the paper "An Approach to Monoethanolamine Solution Control: Chemical Analysis and Its Interpretation." This paper relates chemical analysis to plant operation and suggests remedial steps found effective in eliminating operational difficulties. For a copy, use the coupon provided.

UNION CARBIDE is a registered trade mark of Union Carbide Corporation.

**UNION CARBIDE CHEMICALS COMPANY**
Dept. G, 270 Park Ave., New York 17, New York

PLEASE . . .

- ☐ Send a copy of the paper—*Amine Solution Control.*
- ☐ Have a representative call.
- ☐ Send me information on_____

Name_____ Position_____

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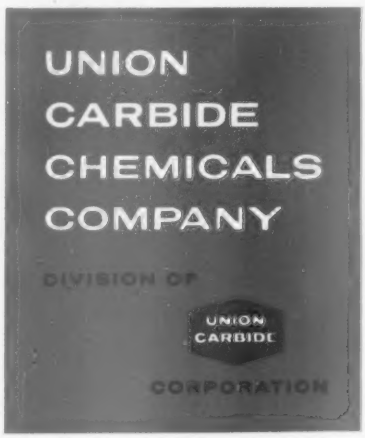


## GARDNER-DENVER 1100 DRAWWORKS—A NEW CONCEPT IN DRILLING RIG DESIGN

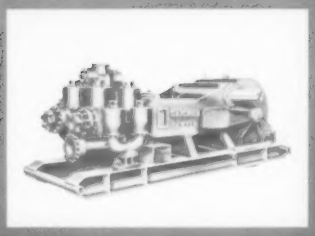
Unique in the oil field equipment industry, Gardner-Denver was able to build the 1100 drawworks without fear of obsolescence for older designs in the field. From the ground up, the 1100 drawworks is a unitized design with each part and detail selected to give a balanced drilling rig that will operate with maximum efficiency under longest and hardest drilling service. ☐ One of a full line of Gardner-Denver drawworks for drilling from 4,000 to 30,000 feet, the 1100 fits programs in the 8,000 to 15,000 foot range. Representative of the entire line, the 1100 design features a new concept of torque/speed combinations that give more usable horsepower and lower maintenance costs. Its short shaft and large bearing arrangement extends service life of these vital components. All controls, transmission and auxiliary brake are integrally mounted on the main skid for faster rigging-up and moving. GARDNER-DENVER

See next page.

©1961 Gardner-Denver Company, Quincy, Illinois

*Balanced/Engineered Drilling Team*

Gardner-Denver drilling equipment has been designed as a matched team for greatest drilling efficiency. In addition to the drawworks and compound there is a swivel, block, rotary table, mud pump and compressor to match every drilling program.



### MUD PUMPS

Gardner-Denver mud pumps have earned one of the finest names in the drilling industry. Ruggedly built, they have double helical gears, counter balanced eccentrics and are fully pressure lubricated for long life of moving parts. Pumps are available in sizes to match the Gardner-Denver 1100 drawworks in rating and capacity.

### 22½ ROTARY TABLE

Only Gardner-Denver rotary tables have Turbo-lubrication to increase the life of working parts. Turbo-lubrication cools and lubricates every moving part with a fast-moving stream of oil. Picked up from the large reservoir by the pinion gear, oil is force-circulated by the ring gear — then centrifugal action speeds the oil flow and distributes it evenly over the gears and main bearing. This large volume of cool oil adds thousands of hours of maintenance-free service to Gardner-Denver rotary tables.

*RIG-MATCHED EQUIPMENT*
*FROM CROWN BLOCKS TO PUMPS FOR THE*

# 1100

## GARDNER-DENVER DRAWWORKS

*Write for the 1100 brochure today!*

### 300-TON TRAVELING BLOCK

Fast, true fall characteristics have been engineered into the Gardner-Denver line of traveling blocks. Unhampered by old designs or tooling, a new ratio of weight to rated capacity has been achieved. For faster falling, up to 2,000 pounds of weight has been added over competitive designs without increasing outside dimensions. For smooth operation, fabricated sheaves with perfect balance . . . both dynamically and statically . . . are used. Matching crown blocks available.

*Gardner-Denver equipment combines imaginative engineering and modern technology with a century of experience.*

### 300-TON SWIVEL

This new line of swivels is rated in "depth range" rather than in older terms of tonnage. This realistic concept is based upon actual field practice where depth, drilling load and speed are usually found consistent over a given drilling range.

Features: High pressure, easy change packing. Low center of gravity. High capacity bearings. Turbo-lubrication. Streamlined steel body for safety and strength.

1 CENTURY

**GARDNER-DENVER**

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# GARDNER-DENVER MAKES THE NEWS

Important changes are now in progress in the drilling industry. As holes have become deeper and costs per foot drilled have continued to rise, operators have become aware of the advantage in using equipment that has been engineered to work together as a balanced team for maximum speed and efficiency. It is only natural that the ultimate in operating economy and efficiency can be achieved when there is a single source for engineering, fabrication and service of this equipment.

Recognizing this need, Gardner-Denver, one of the largest manufacturers of mud pumps, air compressors and air drilling equipment, has now completed a full line of oil drilling equipment for every depth well from 4,000 to 30,000 feet.

Unique in the drilling equipment industry, Gardner-Denver equipment designs were not limited by existing equipment and tooling. Without fear of obsoleting existing stocks, Gardner-Denver engineers directed their efforts to producing the most advanced equipment that could be built . . . to developing new concepts of torque/speed combinations that would give more usable horsepower and lower maintenance costs.

Typical of these new Gardner-Denver drawworks designs is the Gardner-Denver 1100, a 1,100 horsepower drilling unit for depths to 15,000 feet. Similar in basic design to the larger Gardner-Denver 2100 and 1500 drawworks, the Gardner-Denver 1100 is built around a single package, side skidded drawworks. All controls, transmission, auxiliary brake and drawworks are mounted on the main skid. This integral arrangement offers many time saving advantages, including faster rig-up and moving, positive alignment of transmission and permanently mounted control panel.

### Rugged Drawworks Construction

Heavy steel plate, doubled at bearing centers for extra rigidity, is used for the drawworks housing. A continuous ring of steel plate is welded around shaft openings to eliminate distortion of the side plates. This feature greatly increases bearing life. Engineering of sprockets, ratios and bearings has been unitized to produce a balanced torque/speed combination that lengthens chain and bearing life.

### Short Shaft Transmission

Hi and lo main drum clutches give the driller a selection of eight hoisting speeds and a reverse. The transmission is ratioed in four speed increases. Equalization of the speed increases has produced a smooth progression over the entire range.

Short shafts and bearing centers are an outstanding point of the transmission design.

### Tension Bar Equalized Brakes

Extra braking power through 330 degree wrap brakes make the Gardner-Denver 1100 an easy-to-handle rig that will stop the heaviest load with precision. A tension bar equalizes both brakes for a balanced pressure on the rims. A centralized lubrication panel supplies lubricant to all brake linkage.

The driller can control the water level within the hydromatic brake without leaving his station. An indicator gauge and control valve are mounted on the console.

Matching compounds for two and three engines in both stair-step and in-line arrangements are available for the Gardner-Denver 1100.

A brochure covering each drawworks and companion equipment is available on the full Gardner-Denver line. Stop in at your nearest supply store or write direct for your copy.

*Gardner-Denver has great faith in the future of the petroleum industry and the men who have made it one of our nation's most important assets. This confidence is expressed by the recent expansion of its Petroleum Division to include the manufacture of a complete line of drilling equipment: drawworks, rotary tables, swivels and blocks. To assure you of the finest equipment, Gardner-Denver has invested in new tools, plants and obtained the services of the industry's outstanding engineers. All of us at Gardner-Denver are looking forward to serving you through our expanded Petroleum Equipment Division.*

*(Advertisement)*

Better Production Tools Through Research

OTIS Equipment NEWS

*Volume III, Number 2* Otis Engineering Corporation • Dallas *Production Equipment and Services*

# Otis 1¼" I. D. Gas Lift Valves Lift 370 BWPD From New Tubingless Completion Gas Well

LAKE CHARLES—A major Southern Louisiana producing company recently used Type C Otis Macaroni String Gas Lift Valves to unload water from a new tubingless completion to save several thousand dollars in swabbing costs. In excess of 18,000 barrels of water were lifted through the 1¼" I.D. tubing and Otis Gas Lift Valves in less than two months time. Following the unloading operation, the pipe was salvaged and the valves exchanged for a new set of a different size for use in one of the company's oil wells.

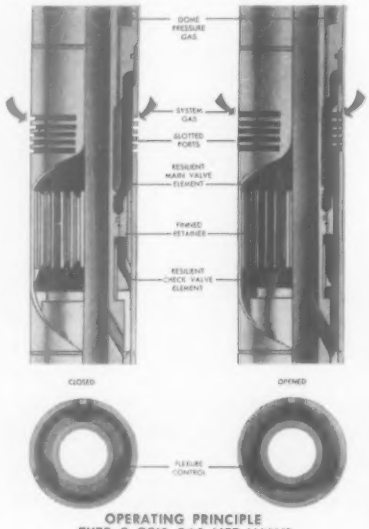
TYPE C OTIS GAS LIFT VALVE

Well conditions at the time the Otis Gas Lift Specialists made their recommendations were as follows: T.D. of the well was 7300 feet. 2⅞" tubing had been run and cemented to serve as a casing. Water encroaching from the down-side of the producing horizon was preventing production.

At the recommendation of Otis Gas Lift Specialists, the operator ran 7250 feet of 1¼" tubing with a packer on the bottom, and nine 1¼" Type C Otis Macaroni String Gas Lift Valves made up in the string. The lowest valve was located at 5900 feet. Using a 900 lb. supply gas system, an average of 370 barrels of water per day were lifted from a valve located at 4400 feet. The injection gas ratio was less than 300 cubic feet per barrel of water. The operator credited Otis Gas Lift Specialists with saving him swabbing costs of between $4,000 and $6,000.

## Valve Design Features

Otis Macaroni String Gas Lift Valves provide the same outstanding design features to be found in the larger, standard size Type C Otis Gas Lift Valves. Available in sizes ranging from 1-13/32" to 3" I.D., Type C Valves have a full-opening bore, collar O.D. and tubing I.D., are concentric in design, have only two moving parts — no moving metal parts, no bellows to fatigue, no seat to cut out and no spread. The valve has one operating pressure — the set pressure of the valve.




OPERATING PRINCIPLE TYPE C OTIS GAS LIFT VALVE

Otis Gas Lift Valves are designed to provide the ultimate in lifting efficiency and capacity, and for use in continuous or intermittent lifting operations without modification. Type C Otis Gas Lift Valves with Pack-Off Assemblies are currently being used to convert wells to gas lift without pulling the tubing. This technique of converting a well to gas lift saved one producer as much as $60,000 in converting three readily accessible land wells.

Otis Gas Lift Specialists and Completion Specialists are interested in helping you complete and produce your wells in the most efficient way possible. Their experience — gained through years of solving difficult production problems encountered in all the major producing areas of the world — will prove invaluable to you. Use the knowledge of these men and spend your production dollars more economically and efficiently. For more information on Otis Gas Lift Valves, sizes and lifting capacities, contact your nearest Otis office or write Otis, Dept. E-2, P. O. Box 35206, Dallas 35, Texas. You'll find experienced Otis Gas Lift and Well Completion Specialists ready to help you . . anxious to serve you . . and with the widest variety of field proven production equipment and services available today.

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OTIS

Engineering Corporation

General Offices

8812 Denton Drive • Dallas

# "What kind of Pumping Control do YOU need?"

## Square D can deliver it from Stock!

**BASIC PANEL can be tailored to fit your needs—**

- NEMA Type 3 "weatherproof" enclosure protects against rain, sleet, hail, snow and dust.
- simplified installation—convenient knockouts for easy wiring, designed for either wall or pole mounting, or available with pedestal mounting feet if desired
- oversized enclosure permits field installation of additional features if required
- choice of fusible disconnect switch or circuit breaker
- HAND-OFF-AUTO selector switch
- available in ratings up to NEMA Size 4 to handle up to 100 hp

**COMPLETE PROGRAMMING PANEL has every feature you need for oil well pumping—**

- two types—one for operation up to 600 volts, another for 762-volt systems
- gasketed inner door isolates "live" parts—NEMA Type 3 enclosure gives complete weather protection
- overload relays in separate ventilated compartment to prevent nuisance tripping
- time clock has trip tabs for easy pumping program setup
- undervoltage release relay drops out on power failure, provides time-delay restart for staggered starting when power is restored
- built-in lightning arrester

*Write for Bulletin 8944. Square D Company, 4041 North Richards Street, Milwaukee 12, Wis.*

SQUARE D COMPANY

*—wherever electricity is distributed and controlled*

# accuracy

**ASHCROFT DURAGAUGES** measure pressure with precise accuracy no matter how severe the conditions of service

*Ashcroft Duragauges are available in pressure ranges from 15 psi (or vacuum) minimum to 100,000 psi. Dial sizes: 4½" through 12".*

# sustained

The Bourdon tube in Ashcroft Duragauges is manufactured to precision standards of flexibility and mono-linked to the rotary movement. When pressure flexes the tube, the gauge pointer is always positively positioned, because it is mounted on the geared center shaft of the movement. Sustained high accuracy and long life are assured.

Choose your Ashcroft Duragauges made of components best suited to your needs. Eight Bourdon tube materials are available. Movement of stainless steel with nylon bearings and pinion gear for longest wear. Case materials: special aluminum alloy or tough phenol plastic.

The unique "Maxisafe®" Duragauge provides absolute protection to the viewer, plus easy and quick access to the mechanism. Your industrial supply distributor will help you select the best combination of components for your Ashcroft Gauge requirements. Phone him today or write for Catalog 300B.

MAXWELL M&M MANNING & MOORE, INC. TRADE MARK

**ASHCROFT PRESSURE GAUGES**

*A product of*

**MANNING, MAXWELL & MOORE, INC.**

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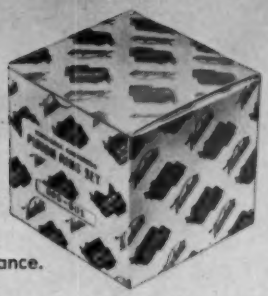
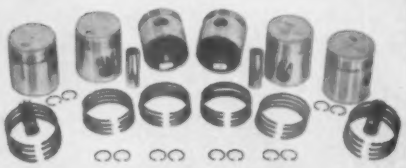
# PROTECT YOUR POWER INVESTMENT...
# BUY *genuine* WAUKESHA PARTS



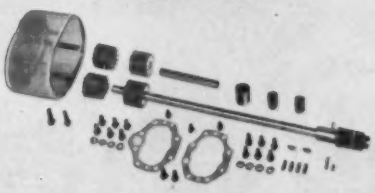
...in the original sealed packages—always obtainable from your Authorized Waukesha Distributor—are your best insurance of continuous satisfaction and economical engine performance.

### PISTONS, PINS, RINGS



Matched in sets for weight and balance. Correctly fitted sizes.

### OIL PUMP PARTS

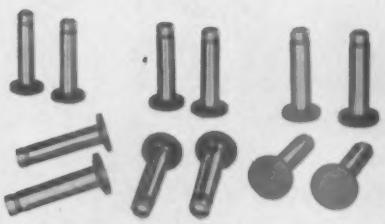


Precision bushings, shaft, gears, clearances. Correct gasket sizes.

### MAIN AND ROD BEARINGS

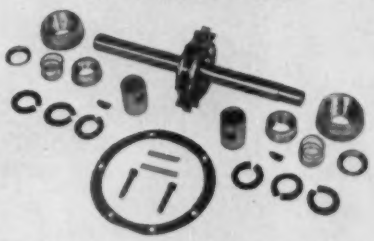
Absolutely clean. Numbers correct. Best materials. Perfectly sized.

### VALVE LIFTERS



Factory heat-treated and ground. Accurate metallurgy and dimensions.

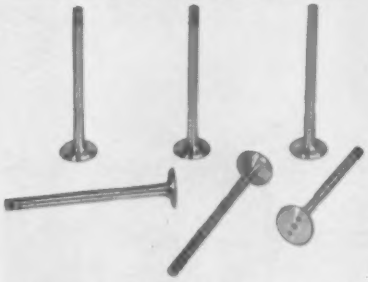
### WATER PUMP PARTS



Precision bushings, shaft, seals—accurately balanced impellers.

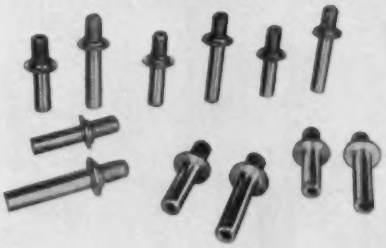
> **"There is hardly anything in the world that someone cannot make a little worse and sell a little cheaper—and the people who consider price alone are this man's lawful prey."**
>
> *—John Ruskin*

### INTAKE AND EXHAUST VALVES



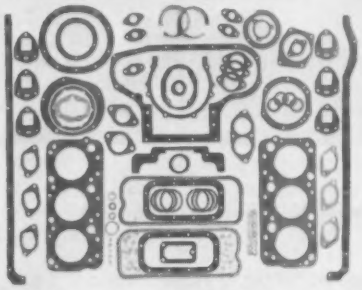
Quality and best materials ensured—no nicks, burrs, hand prints.

### VALVE GUIDES



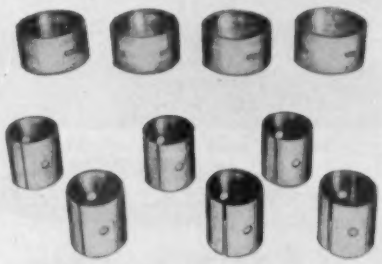
Service sized; inside and out—give just-right valve lubrication.

### COMPLETE GASKET SETS



A right gasket for every place on your engine—dimensionally stable.

### CAMSHAFT AND PIN BUSHINGS



Pre-sized for service use—no distortion—precise oil metering.

For that extra quick service call your Waukesha Distributor — see alphabetical section, or Yellow Pages in your phone book—you'll have your repair parts in a hurry!

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Factories at Waukesha, Wisconsin and Clinton, Iowa

513

# OPERATOR SAVES THOUSANDS OF DOLLARS ON DEEP WORKOVER!

***And Service Contractor Makes A Fair Profit, too!***

**This well had been drilled to 16,700′, plugged back to 16,036′ and completed in the open hole. A packer had been set in the 7″ casing above the plug. In working over the well, the packer was milled-over and retrieved, the plug was drilled out from 16,036′ to 16,200′ and a 5″ liner was set from 15,551′ to bottom. A total of 16,200′ of 2⅞″ drill pipe was used for the job. It was necessary to pull over 200,000 lbs. hook load in recovering the milled-over packer.**

**The work was performed by Nomad Drilling and Servicing Company with a Cardwell KM250 Drive-In Rig.**

**The operator selected this particular rig because of its capabilities and low cost, considerably less than the cost of a conventional drilling rig. The KM250 has shown outstanding ability to keep up with conventional drilling rigs normally used on medium and deep workover jobs. The operator stated that, in comparison, the KM250 saved 50% on moving-in and rig-up costs and upwards of $75 per day on day work.**

**More and more operators are specifying Cardwell Drive-In Rigs for workover, completion and service work. The cost is lower and work is performed faster. Cardwell rigs save money on maintenance costs. This means a better profit for the contractor and lower costs for the operator.**

**Cardwell rigs are always busy. Call your nearest Cardwell representative, he will show you why!**

Nomad Rig No. 3 with 16,200′ of 2⅞″, grade "E" drill pipe. Hook load of pipe — 170,000 lbs. ▶



Mr. Ivan H. Newton
Nomad Drilling and Servicing Co.

*for tomorrow's equipment—see Cardwell today!*

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Trans-Canada Pipe Lines Limited Chooses Worthington SUTC's . . .

# FOR FIRST FULL AUTOMATION

At central control, the dispatcher pushes a button. At the compressor station miles away, a solenoid throws an air valve. Engine and compressor cylinders begin purging . . .

At 6 seconds, ignition actuates, fuel is admitted and the engine slowly accelerates toward 160 rpm. At 20 seconds the compressor cylinders stop purging. In 5 minutes, the engine-compressor is ready to be brought on line.

This is a glimpse of normal operation of Trans-Canada Pipe Lines Limited's Maple Station—the first to be fully automated by this pipeline company. Three Worthington SUTC engine-compressors operate in pre-set sequences according to signals from the dispatcher who, though 25 miles away, could be a thousand.

These new SUTC's have a higher compression ratio for increased efficiency; improved handling of heat load through new computer-designed Turbo-Chargers; and new bearing construction. Cylinder parts and Double Deck valves were manufactured in Canada.

The station organization chart shows the benefit of these automated SUTC's. This station has no operators. This saves initial cost of four houses and salary and overhead for the operators.

For complete information on SUTC's for automated or conventional installations, call your nearest Worthington District Office. Or write Worthington Corporation, Dept. 43-22, Buffalo, New York. In Canada, Worthington (Canada) Ltd., Brantford, Ontario.

WORTHINGTON

PRODUCTS THAT WORK FOR YOUR PROFIT

# HOW WOULD YOU LIKE TO GET AT LEAST ONE VIBRATOR HOSE FREE?

You get one or more lengths of vibrator hose free* when you equip your rig with Goodall Long-Life Rotary Hose, by actual proof the finest rotary hose on the market. Here's the way it works — you get the maximum use from your Goodall rotary hose (and it's built to last longer), then instead of throwing this worn and damaged hose on the scrap heap, you return it to us. We reset the Barney Couplings to give you one or more lengths of vibrator hose, test this hose and send it back to you!

Goodall hose is the only rotary hose that can be repaired and re-used. Goodall Long-Life Rotary Hose is the strongest, most flexible, most perfectly balanced hose money can buy, but it costs no more than ordinary hose. And Goodall unconditionally guarantees it for one year. Your best buy is Goodall Long-Life Rotary Hose — available through all supply stores.

*Plus a nominal cost for resetting the couplings.

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Available through all qualified supply stores.

This mark tells you a product is made of modern, dependable Steel.

# Now Available...

## USS QUENCHED AND TEMPERED STRUCTURAL SHAPES

### in such grades as "T-1", "T-1" type A, 9% Nickel and HY-80 Constructional Alloy and Armor Steels

Announcing another industry "first" for United States Steel—USS Quenched and Tempered Alloy and Armor Steel Structural Shapes are now commercially available for the first time anywhere, in the types and sizes shown in the accompanying tables. The more commonly used sizes of American Standard Beams, Channels, Equal Angles and Unequal Angles will be produced in these USS Steels: "T-1", "T-1" type A, 9% Nickel, HY-80 and certain other alloy grades that provide desirable mechanical properties after quenching and tempering. Later, other sizes and shapes will be added according to demand.

These quenched and tempered alloy and armor steel structural shapes (see table below) can simplify design and result in substantial weight savings, increased structural strength and reduced shipping and handling costs. For a free folder about any of these steels or their structural shapes, contact your local USS representative or write to United States Steel, Room 6312, 525 William Penn Place, Pittsburgh 30, Pa. USS and "T-1" are registered trademarks

United States Steel Corporation • Columbia-Geneva Steel Division • Tennessee Coal & Iron Division • United States Steel Supply Division • United States Steel Export Company

**Availability** Quenched and Tempered standard structural shapes are available in the following shapes and sizes:

| | | |
|---|---|---|
| I | Beams: 6″ to 12″ inclusive | American Standard Sections and Foot Weights* |
| [ | Channels: 6″ to 15″ inclusive | American Standard Sections and Foot Weights* |
| L | Equal Angles: 3″ to 8″ inclusive | Standard Sections* |
| L | Unequal Angles: 3½″ x 3″ to 8″ x 6″ inclusive<br>Maximum Length 40′ for all sections | Standard Sections* |

*See our booklet, "USS Shapes & Plates," ADUCO-27001

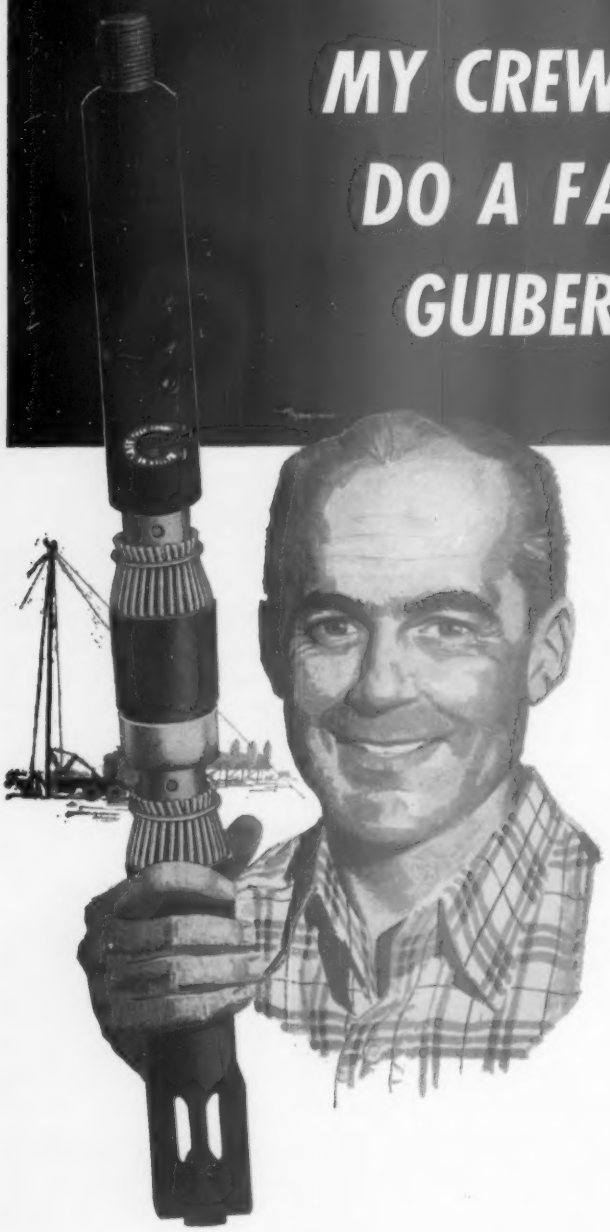
**Mechanical Properties** of Quenched and Tempered Alloy and Armor Steel Structural Shapes

| | Yield Strength, psi | Tensile Strength, psi | Elong. in 2", % min. | Reduction of Area, % min. | Longitudinal Charpy Impact (when specified) | |
|---|---|---|---|---|---|---|
| | | | | | Keyhole | V-notch |
| "T-1" Steel 2½" and Under | 100,000 (min.) | 115,000/140,000 | 18 | 55① | 15 ft.-lbs. @ −50F | 30 ft.-lbs. @ +10F |
| "T-1" type A 1" and Under | 100,000 (min.) | 115,000/140,000 | 18① | 45② | 15 ft.-lbs. @ −50F | — |
| Grade A 9% Nickel | 60,000 min. | 90,000 min. | 22% min. | — | 15 ft.-lbs. @ −320F | 20 ft.-lbs. @ −320F |
| Grade B 9% Nickel | 65,000 min. | 95,000 min. | 20% min. | | | |
| HY-80 ⅛"-2" Incl. | 80,000/100,000③ | — | 19④ | — | — | 70 ft.-lbs. @ −120F |

①¾" and under—45% min.
②½" and over, yield strength range is 80/95,000 psi
③¾" to 1" inclusive, elongation 16% min.
④½" to 2" inclusive, elongation 20% min.
⑤¾" to 1" inclusive, 55% min.

USS United States Steel

# MY CREWS DO A FASTER JOB with GUIBERSON SWABS



There's no substitute for a fast-falling, smooth-pulling Guiberson swab in speeding-up swabbing operations. Crews make fewer trips .. do a better clean-out job .. lift more fluid per hour. So naturally they're in and out quicker .. at the *lowest possible* swabbing cost. Match one of these cups to your swabbing job.

**TYPE J** .. lifts heaviest loads
**TYPE L** .. lifts medium or light loads
**TYPE GW** .. for light loads
**TYPE K** .. general purpose cup to 6,000 feet
**SIMPLEX** .. lifts fluid containing suspended sand

More than a third of a century of swab-making experience is behind each Guiberson swab and cup. No matter what type of production .. shallow or deep .. light or heavy loads .. smooth, rough or tight tubing .. you will pull more fluid with Guiberson swabs and cups. Regardless of your swabbing problem, you can meet it .. solve it .. quicker and cheaper with a Guiberson swab.

*Cups are compounded to Guiberson's exclusive formulas for* ***maximum resistance to oil .. acid .. abrasion.***

SAFER THAN SORRY — BETTER OR NOT? GUIBERSON

THE GUIBERSON CORPORATION

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DALLAS, TEXAS
U. S. A.

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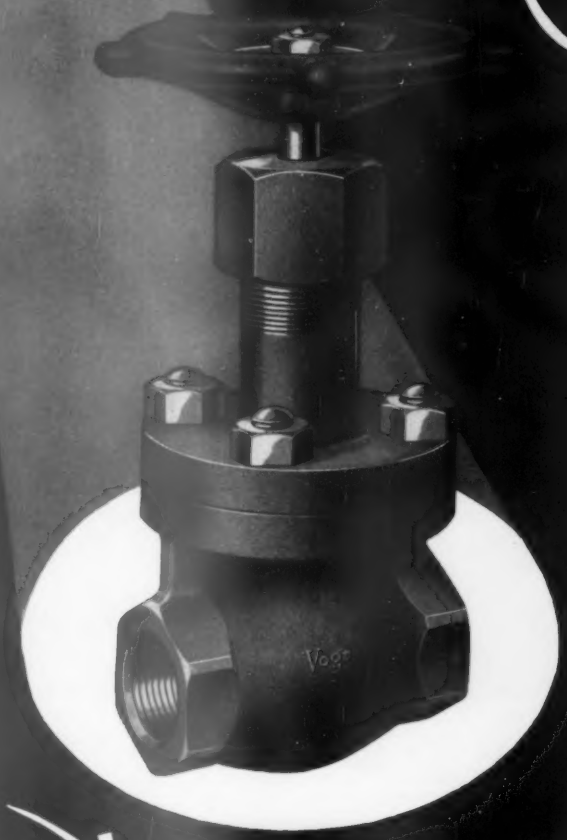
Sold by Oil Field Supply Stores Everywhere

# Spotlighting 2 NEW VOGT VALVES



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**FORGED STEEL**

**INSIDE SCREW**

**Bolted Bonnet**

GENERAL GP PURPOSE

**GATE and GLOBE**

## VALVES

**150-800 Pounds Service**

**2000 Pounds Cold, W.O.G.**

Available from stock in ¼" thru 2" sizes and in both socket weld and screw ends.

## CHECK THESE FEATURES

1. Forged steel pressure containing parts designed for light weight and brute strength.
2. Hard faced seats and hardened discs and wedges.
3. Spiral wound stainless steel or Monel gaskets to suit trim.
4. Extra deep stuffing box for long packing life.
5. Dished sure-grip handwheel.

*Write for literature Dept. 24A-FO*

**HENRY VOGT MACHINE CO., LOUISVILLE, KY.**

SALES OFFICES

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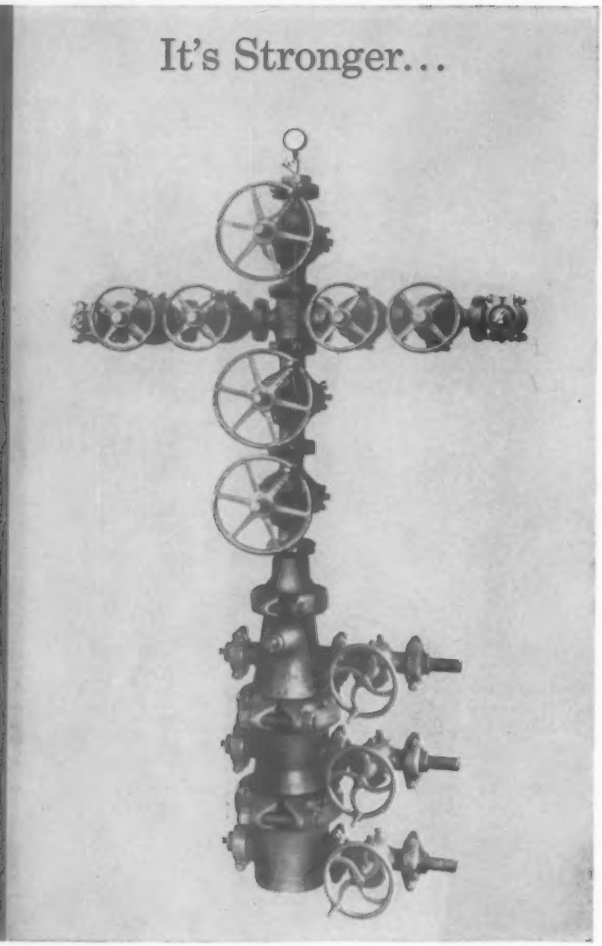
Vogt

GENERAL GP PURPOSE

Vogt Valves Valves & Fittings

**FORGED STEEL**

**VALVES**




# It's Better BECAUSE OF GRAYLOC

A Gray Well Head assembly, with GRAYLOC® connections, weighs about 26% less than a comparable flanged hook-up, yet it withstands an equal pressure. With only two bolts per connection, it's easier and quicker to nipple-up than flanged units and the assembled unit is about ⅓ smaller.

You save labor, space and time while getting the utmost blow-out protection and the longest possible stretch for your production dollar.

Why not let Gray assemblies help you bring your cost down? A great many of our customers have. Just ask your Gray representative or write today for more details.

| | Flanged Assembly | GRAYLOC Assembly |
|---|---|---|
| Test Pressure | 15,000 | 15,000 |
| Height | 136" | 111" |
| Center to center of Flow Wings | 95" | 86" |
| Weight | 6,591# | 4,878# |

GRAY *Tool Company*

6102 P. O. BOX 2291 HOUSTON 1, TEXAS RIVERSIDE 7-1240

**on-time record**
**on-time record**
**on-time record**
**on-time record**
**on-time record**

It's our record and we keep repeating it. Month in, month out, government statistics* show that Braniff's on-time record is consistently one of the best in the field. (Often it is first.)

The time we devote to punctuality is just one of Braniff's extra attentions. The "extra" goes into the brisk ticketing and baggage efficiency we've developed . . . and the elegant Silver Service we serve coffee in after meals. (The meals are extra special indeed! So is the charm Braniff hostesses put into their smiles and hospitality.)

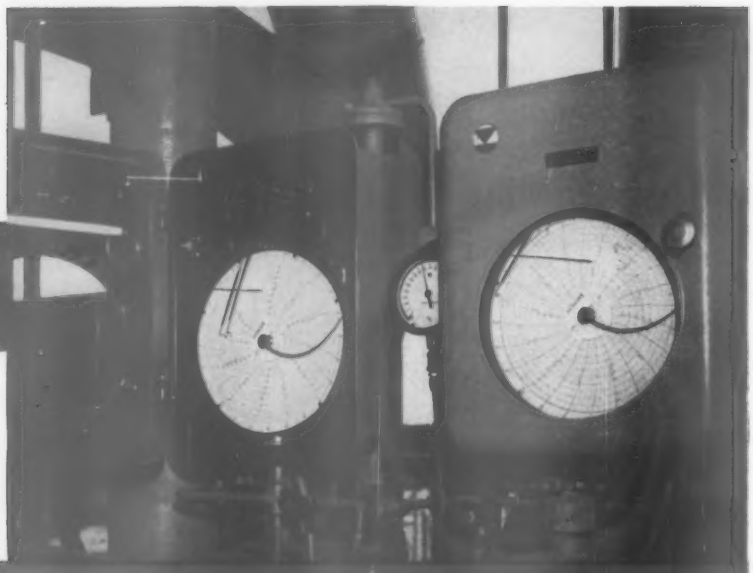
Men in the oil and gas industries appreciate our know-how in making flying relaxing and pleasant. And they appreciate the way our new Boeing Super Jets get them swiftly and comfortably to their destination.

Our extensive routes in the Midwest lead from the heart of the oil and gas country to New York, Chicago or Washington. (50 U.S. cities in all.) And Braniff also serves the oil and gas-rich lands of South America from Texas, and from New York/Miami via Braniff-Eastern thru-jet service.

Try us out soon. See why we go on record saying: You belong on Braniff.

**BRANIFF *International* AIRWAYS**

*CAB compilations: on-time accuracy to within 15 minutes.



American Integrating Orifice Meters, in a duplex setting, measure gas for boiler at Ft. Lauderdale power plant. These meters are equipped with a fixed gear train to provide a direct reading in cubic feet of gas at base conditions.

# AMERICAN® instrumentation solves measurement problem for Florida Power and Light Co.

Florida Power and Light's Ft. Lauderdale power plant. Two of five boilers use 45 million cubic feet of gas per day on an interruptible basis, can consume up to 60 million cubic feet daily.

In each of the eight Florida Power and Light Co. power plants throughout the state, several boilers are fueled by natural gas. Florida Power and Light required a meter that provided a direct reading in actual cubic feet of gas used by each boiler. Measurements would then be transmitted by Telemetering to central data-gathering offices.

American Meter Company supplied a modified Integrating Orifice Meter with a counter reading in cubic feet of gas at standard base conditions that solved their unique measurement problem.

Whether your requirements are simple or complex, you can rely upon American Meter's 125 years of engineering experience to give you the dependable equipment you need for years of accurate, trouble-free measurement and control.

**AMERICAN® METER COMPANY**

GENERAL SALES OFFICE: Philadelphia 16, Penna. • Albany
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# JEFFERSON GAS TREATING BRIEFS

## GLYCOL ABSORPTION DEHYDRATION

Low initial capital expenditure, simplicity and low cost of operation have established the glycol dehydration process as the most practical for the natural gas industry.

Triethylene glycol is the most commonly used glycol for dehydration by absorption. HI-DRY®, Jefferson's tetraethylene glycol desiccant, is used in absorption units where additional dew point depression is required. Diethylene glycol is preferred in vacuum regeneration type absorption units and in the mixed glycol-amine process which dehydrates and sweetens simultaneously.

### RECONCENTRATION

The amount of dehydration obtained by the glycol absorption process is limited by the amount of water left in the lean glycol after reconcentration. A lower water content may be obtained in the lean glycol solution by the use of vacuum reconcentration or stripping gas without exceeding the maximum recommended temperatures of reconcentration shown below.

| Glycol | Initial Decomposition Temperature, °F. | Recommended Reconcentration Temperature, °F. max. |
|---|---|---|
| Diethylene | 328 | 340* |
| Triethylene | 404 | 375 |
| HI-DRY® | 460 | 430 |

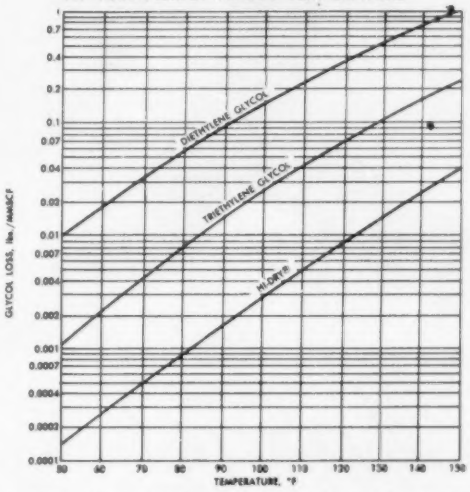
*When oxygen or hydrogen sulfide are present, lower temperatures in the range of 310° to 320° F. are recommended.*

### GLYCOL LOSSES

Control of glycol losses is one of the most important operating problems in absorption type dehydration plants. Normal glycol consumption will usually run less than 0.5 lb./MMSCF in the larger plants which have close supervision of operation. A glycol consumption of 1.0 lb./MMSCF for field units is generally acceptable. Average cost for glycol make-up requirements will account for about 30 to 40% of the total operating costs.

Major glycol losses result from (1) flooding of the contactor by surges of gathering line liquids and (2) entrainment of glycol in the contactor overhead. Mechanical leakage can also be significant. At normal contact temperatures, equilibrium glycol vaporization losses are relatively minor in comparison with the total glycol loss. When high contact temperatures are involved, glycol vaporization losses become more important in the overall cost of operation. Figure below can be used to estimate equilibrium glycol vaporization losses.

CALCULATED EQUILIBRIUM VAPORIZATION LOSSES AT 1000 P.S.I.G. VERSUS TEMPERATURE




*This figure shows that the higher glycols, such as triethylene glycol and HI-DRY® desiccant, have the advantage of low vaporization loss at the higher contact temperatures.*

### DESIGN CONSIDERATIONS

In recent years there has been a tightening of water specifications on gas sold to transcontinental pipelines. As limitations are reached in reconcentration of the glycols, the amount of contact and glycol circulation rates become increasingly important. Glycol circulation rates of three gallons per pound of water absorbed and four tray contactors meet normal dehydration requirements. Locations needing maximum dew point depression may use circulation rate of 10 to 15 gallons per pound and contactors with six to eight trays.

Installation of an inlet gas scrubber to prevent contactor flooding and a contactor overhead mist eliminator for prevention of entrainment are recommended design features.

*For complete information on Jefferson glycols, ethanolamines, and helpful technical services . . . contact Jefferson Chemical Company, Inc., 1121 Walker Avenue, P. O. Box 303, Houston 1, Texas.*

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ROLLED THREAD
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For detailed information see your W. C. Norris sales representative or write for brochure entitled "What About Undercut Pins and Rolled Threads".
Norris continues to furnish conventional API threaded pins in sizes up to 1 1/8".

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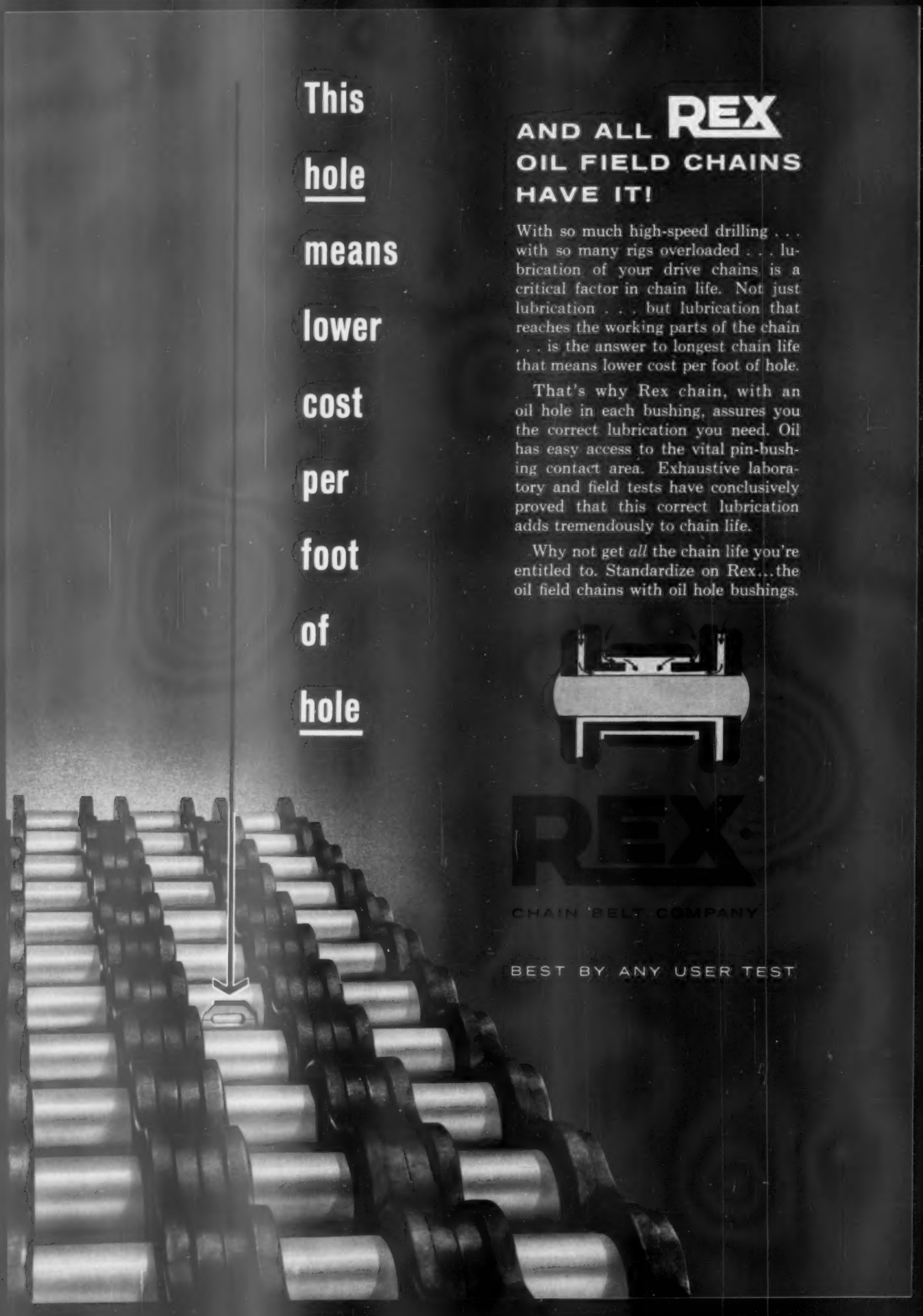
This hole means lower cost per foot of hole
AND ALL REX OIL FIELD CHAINS HAVE IT!
With so much high-speed drilling . . . with so many rigs overloaded . . . lubrication of your drive chains is a critical factor in chain life. Not just lubrication . . . but lubrication that reaches the working parts of the chain . . . is the answer to longest chain life that means lower cost per foot of hole.
That's why Rex chain, with an oil hole in each bushing, assures you the correct lubrication you need. Oil has easy access to the vital pin-bushing contact area. Exhaustive laboratory and field tests have conclusively proved that this correct lubrication adds tremendously to chain life.
Why not get all the chain life you're entitled to. Standardize on Rex...the oil field chains with oil hole bushings.
REX
CHAIN BELT COMPANY
BEST BY ANY USER TEST

# LONGEST CHAIN LIFE AT EXTREMELY HIGH SPEEDS... HEAVY LOADS

## Rex DRIVE-FIT Roller Chains

Where chain drives must operate at extremely high speeds, under heavy loads, Rex DRIVE-FIT Roller Chains will deliver the longest possible operating life.

The pins in these chains are a drive-fit in *both* outer and inner pin link plates to assure maximum holding power . . . equalize load distribution over all chain parts. These are the finest chains ever developed for oil field drilling service . . . will assure the lowest chain cost per foot oil hole.

To facilitate coupling and uncoupling of the drive, a unique TAP-FIT connector link has been developed. Pins in this connector link are a "tap-fit" through the inner pin link plates and assure sufficient holding power for maximum chain drive life.

# MAXIMUM EASE OF CHAIN COUPLING AND UNCOUPLING

## Rex GLIDE-FIT Roller Chains

Where easiest coupling and uncoupling of the drive are required, Rex GLIDE-FIT Chains are the most efficient answer. Pins in these chains are a *drive-fit* in the outer pin link plates only, but are a slip or "glide-fit" through the specially designed inner pin link plates. It is only necessary to drive the pin the thickness of a single link plate to uncouple the chain at any link in the chain strand.

With the special design of the inner pin link plates and the other exclusive Rex features, Rex GLIDE-FIT Chains will provide longer life than other "slip-fit" type chains . . . a fact proved in exhaustive laboratory and field tests in actual rig operation.

Write for your copy of Oil Field Catalog No. 6116. CHAIN Belt Company 4683 W. Greenfield Ave., Milwaukee 1, Wis. In Canada: Rex Chainbelt (Canada) Ltd., Toronto and Montreal.

REX OIL FIELD ROLLER CHAINS

BEST BY ANY USER TEST

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# FUMES . . . another reason why storage tanks should be protected with PITTSBURGH TANKHIDE®!

• **Made with fume-resistant titanium pigments** and special weather-resistant vehicles, Pittsburgh's Brilliant White TANKHIDE assures: **(1) Superior resistance to the discoloring effects** of harsh fumes, gases and smoke that often envelop storage tanks. **(2) Gleaming whiteness and high solar reflectance** that help turn back the heat of the sun and cut down costly evaporation losses. **(3) A special "self-cleaning" action** that helps TANKHIDE *keep* its valuable whiteness longer. **(4) Greater protection against corrosion** and weather-wear.

• **TANKHIDE has the toughness** and durability you need in a coating for petroleum or gas storage tanks. For full details, write, wire or phone Pittsburgh Plate Glass Company, Industrial Finishes, 1 Gateway Center, Pittsburgh 22, Pa.

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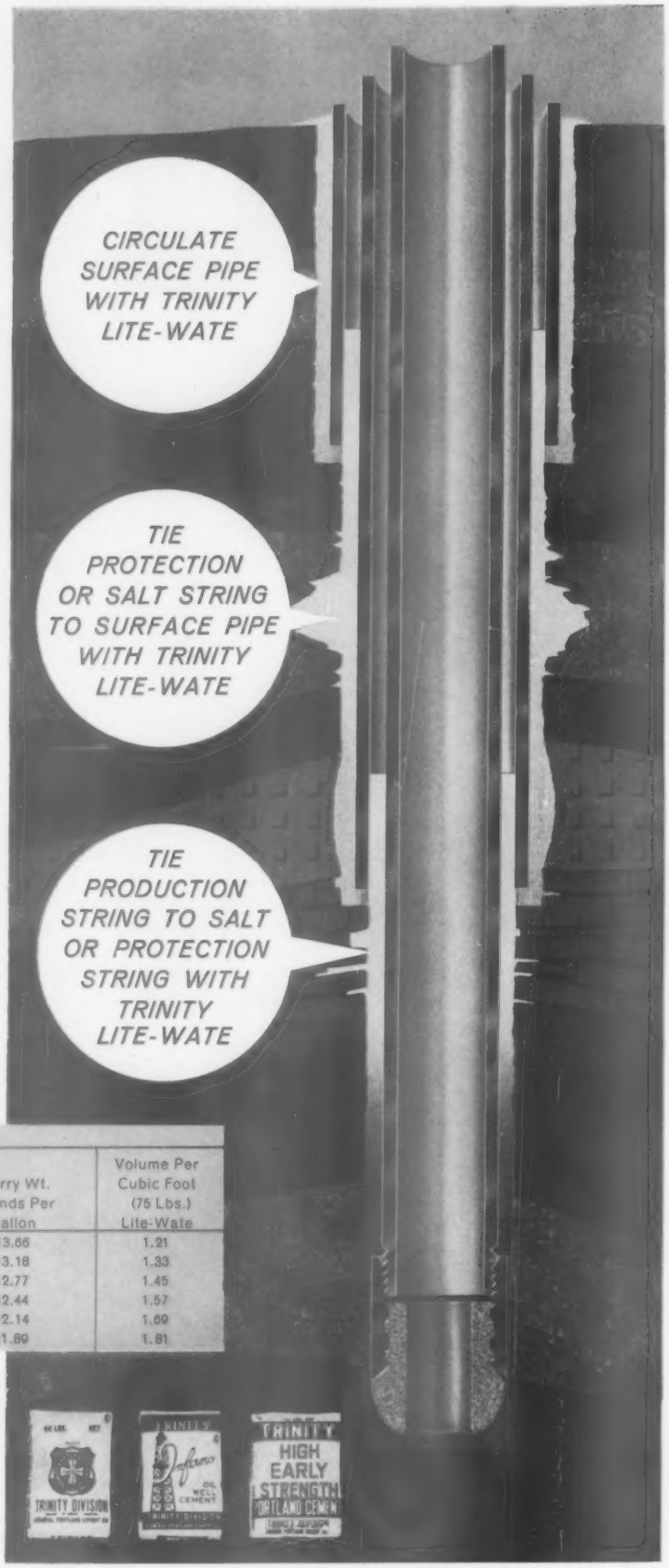
# Trinity
# LITE-WATE
## A Complete
# LOW-DENSITY CEMENT

### No loss to weak formations

**Trinity Lite-Wate is a neat oil well cement with a low slurry density. Nothing to add but water. It derives its light weight properties entirely from the high quality raw materials from which it is made. Easy mixing, easy pumping, can be circulated with low pump pressure and without loss to weak formations. It has proved satisfactory in circulating the surface pipe, tying protection or salt string to surface pipe and tying production string to protection or salt string.**

**Trinity Lite Wate has been in use for several months in such varying well conditions as found in West Texas, Oklahoma, East Texas, Louisiana, Gulf Offshore and New Mexico, it has produced returns in *every case* where attempted.**


CIRCULATE SURFACE PIPE WITH TRINITY LITE-WATE
TIE PROTECTION OR SALT STRING TO SURFACE PIPE WITH TRINITY LITE-WATE
TIE PRODUCTION STRING TO SALT OR PROTECTION STRING WITH TRINITY LITE-WATE
TRINITY DIVISION
TRINITY
OIL WELL CEMENT
TRINITY
HIGH EARLY STRENGTH PORTLAND CEMEN

### SLURRY PROPERTIES

All slurries were mixed in accordance with procedures in the API RP 10B. Slurry weight and volume were calculated on the basis of Lite-Wate specific gravity of 2.80. Absolute volume 3.22 gallon. Absolute volume cubic foot 0.43.

| Mixing Water | | | | |
|---|---|---|---|---|
| Per cent | Gallons Per Cubic Foot Lite-Wate (Dry Vol. 75 Lbs.) | Initial Viscosity Poises | Slurry Wt. Pounds Per Gallon | Volume Per Cubic Foot (75 Lbs.) Lite-Wate |
| 65 | 5.85 | 13 | 13.66 | 1.21 |
| 75 | 6.75 | 8 | 13.18 | 1.33 |
| 85 | 7.65 | 4 | 12.77 | 1.45 |
| 95 | 8.55 | 3 | 12.44 | 1.57 |
| 105 | 9.45 | 2 | 12.14 | 1.69 |
| 115 | 10.35 | 1 | 11.89 | 1.81 |

TRINITY

PORTLAND CEMENT DIVISION

GENERAL PORTLAND CEMENT COMPANY

GPCC

DALLAS·FT.WORTH·HOUSTON

Model 3195 centrifugal pump

# WHY THIS DUCTILE IRON PUMP HITS 500°F...WITHOUT RISK...WITH LESS COST

Now you can pump liquids as hot as 500° F, low-specific-gravity hydrocarbons and other tough services at working pressures to 275 PSIG without the extra cost of carbon steel.

Ductile Iron resists stress, impact and high pressure as much as carbon steel does—because it has properties similar to carbon steel's.

| | Tensile Strength | Yield Strength | Elon-gation | Notes |
|---|---|---|---|---|
| Cast Iron A48-56 | 30,000 PSI | 0 | 0 | |
| Goulds Ductile Iron (ASTM A395-56T) | 60,000 to 70,000 PSI | 45,000 to 50,000 PSI | 15-25% | As heat treated to full ferritized anneal |
| Carbon Steel ASTM A-216-59T-WCB | 70,000 PSI | 36,000 PSI | 22% | |

**3 Tests Prove Your Pump's Toughness.** Each heat of Ductile Iron goes through three rigorous tests—physical, chemical and microscopic.

We break and twist test bars to make sure tensile strength and elongation conform to ASTM-A395-56T specs. We run a chemical analysis to assure the right base chemistry. Microscopic analysis tests for spheroid structure of graphite and completeness of ferritization.

You can get information covering each heat and all castings poured from it. Or we can make tests to your specs.

There's a big story on the Goulds Model 3195, available "off the shelf" in Ductile Iron. Ductile Iron compares to carbon steel in ductility, impact resistance and resistance to thermal shock. Costs less. Both pumping units and pump parts are highly interchangeable. It's available in Ductile-Ni-Resist when corrosion is a factor. Bulletin 725.1 can fill you in with all the details—dimensional interchangeability, bearing frame selection chart, pressure-temperature chart and other helpful information.

Just write Goulds Pumps, Inc., Dept. 06J-51, Seneca Falls, New York.

**GOULDS PUMPS**

## UOP PROCESSES, PRODUCTS AND SERVICES FOR THE PETROLEUM INDUSTRY

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LABORATORY SERVICE
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*Shown here are the basic UOP activities serving the petroleum industry. UOP will be happy to provide more detailed information on any UOP process, service or product.*

**PETROLEUM REFINING AND PETROCHEMICAL PROCESSES** . . . in all UOP offers 23 processes for the production of the full range of petroleum products.

**MARKET RESEARCH SERVICE** . . . includes evaluation of markets and potentials, geographic factors, marketing trends, personnel requirements, and process application planning.

**FIELD SERVICE** . . . UOP maintains an experienced staff of refinery experts located in strategic areas of the free world. These specialists are available to handle processing and allied problems encountered by refiners.

**LABORATORY SERVICE** . . . Available to refiners, this service consists of crude evaluation, product stability analysis, gas concentration equipment performance, and allied problems in processing and product quality.

**REFINERY STAFF INSTRUCTION** . . . UOP provides expert staff instruction in training refiner's process operators in conjunction with the installation of UOP process units.

**UOP PRODUCTS** . . . UOP catalysts, developed and manufactured to exacting specifications of purity and high activity, assure efficient processing. In addition UOP offers a wide range of inhibitors and antioxidants for maintaining the quality of petroleum products. These additives enable refiners to solve such problems as product contamination, stability, color, viscosity, gum formation, and maintenance of octane values.

# how UOP serves the petroleum industry so well

The fullest measure of service to the petroleum refining industry has been and will continue to be UOP's purpose. Starting with the research and design of petroleum refining and petrochemical processes, through the field and laboratory services performed in conjunction with these processes, UOP has directed its capacity to provide a wide variety of elements needed to aid the refiner in producing and marketing the best quality petroleum products.

Keeping refined products stable and maintaining product quality in transportation, storage, and use is an important area of UOP's aid to refiners. Over the years Universal has developed a wide range of petroleum inhibitors and additives to give refiners a reliable and economical means to safeguard the quality of their petroleum products.

**Hundreds of refiners** the world over are customers for UOP processes, services and products. Some use all . . . others use only certain specific processes, services or products. If you have a petroleum processing, marketing or product quality problem, talk it over first with UOP.

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MEANS PROGRESS TOMORROW

UOP

**UNIVERSAL OIL PRODUCTS COMPANY**

30 Algonquin Road, Des Plaines, Illinois, U. S. A.

# They Say—

## The expert touch

Dear Sir:

The guy who wrote the title "Will Success Foil Rock Hunters?" (OGJ, April 24, p. 205) deserves a raise.

Week after week in my own work I try to inject a few light touches to add a glow to a report that otherwise could be too technical and dull. Readers deserve better on Monday morning.

So, I can recognize here the touch of a real expert . . . please treasure him highly. Anyone with such a marvelous title could work for months to dream up an article to go with it—or maybe that's what Frank Gardner did.

Nancy Royal
New Mexico Statehouse
Reporting Service
Santa Fe

## He's right

Dear Sir:

Your April 10 issue, Page 82, included an article "Higher Strength Pipe Sought by AGA Group."

Please advise whether the word "magnesium" in the twenty-third line of the middle column should be "manganese."

W. D. Webb
Design Division
Du Pont
Wilmington, Del.

*Our apologies. It should be manganese.—Ed.*

## Coconut trees are missing

Dear Sir:

I would like to respectfully call to your attention a grave error in the May 1 issue of The Oil and Gas Journal.

If you will turn to Page 171 and check the picture at the bottom of the page, you will see that the caption describes this landing craft as LSM. This craft is an LCM, or Landing Craft Mechanized.

This scene looks very familiar. Only things missing are coconut trees and New Guinea natives without clothes.

I operated one of these craft for


the OIL AND GAS JOURNAL

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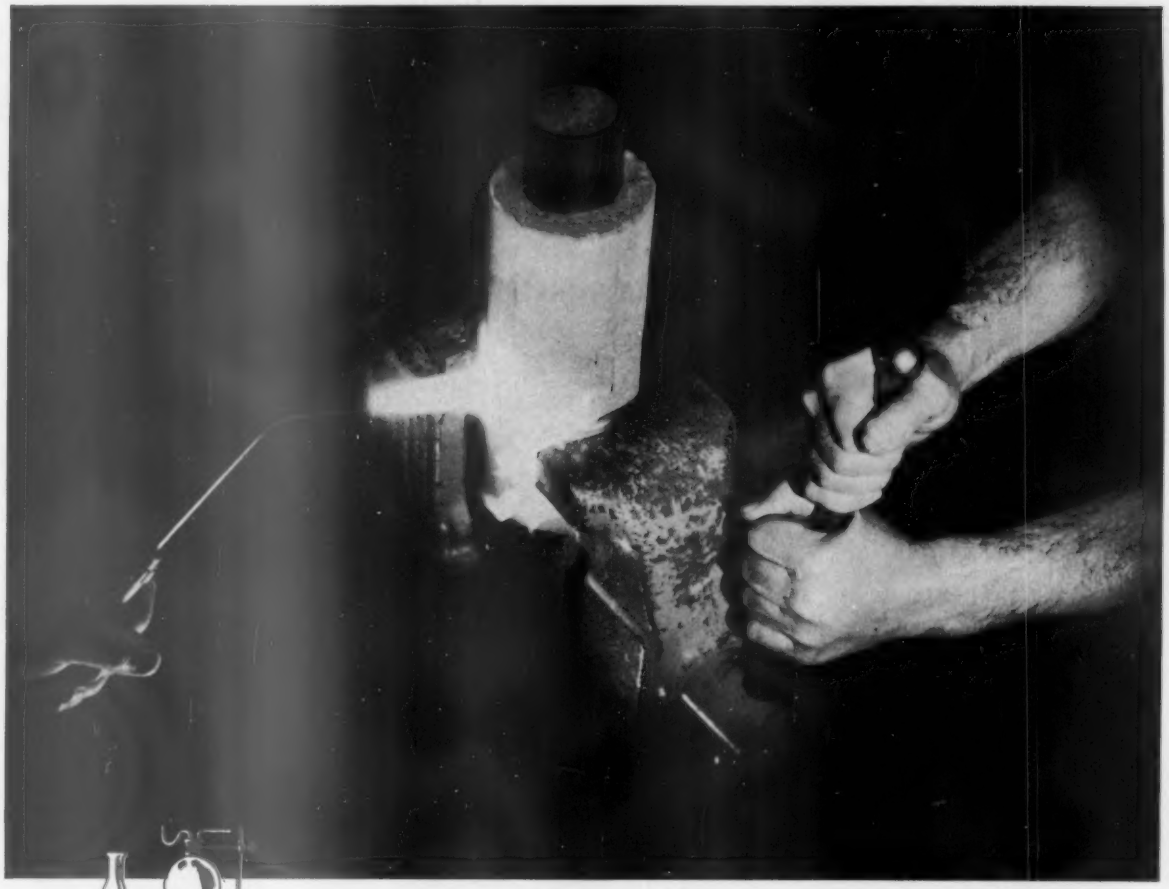
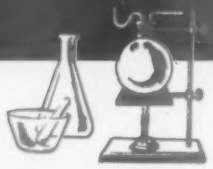




# NEW STABILIZER

## helps prevent loss of cement strength in hot holes

**HALLIBURTON SILICA FLOUR** now makes it possible to maintain or improve cement compressive strengths and keep cement permeability *low* in even the hottest wells.

Portland-type cements show drastic strength retrogression when subjected to high temperatures. A cement having a good compressive strength of 4,500 to 5,000 psi may lose *half* this strength in only 14 days exposure to high well temperatures. Silica Flour reacts chemically with the cement to help combat this strength retrogression.

Experience in cementing over 500 hot holes using blends of 20 to 40 per cent Silica Flour with retarded cements has shown impressive results in controlling strength retrogression and undesirable permeability increase. This additive is compatible with all commonly used cements, retarders, low water loss additives, weighting and lost circulation materials.

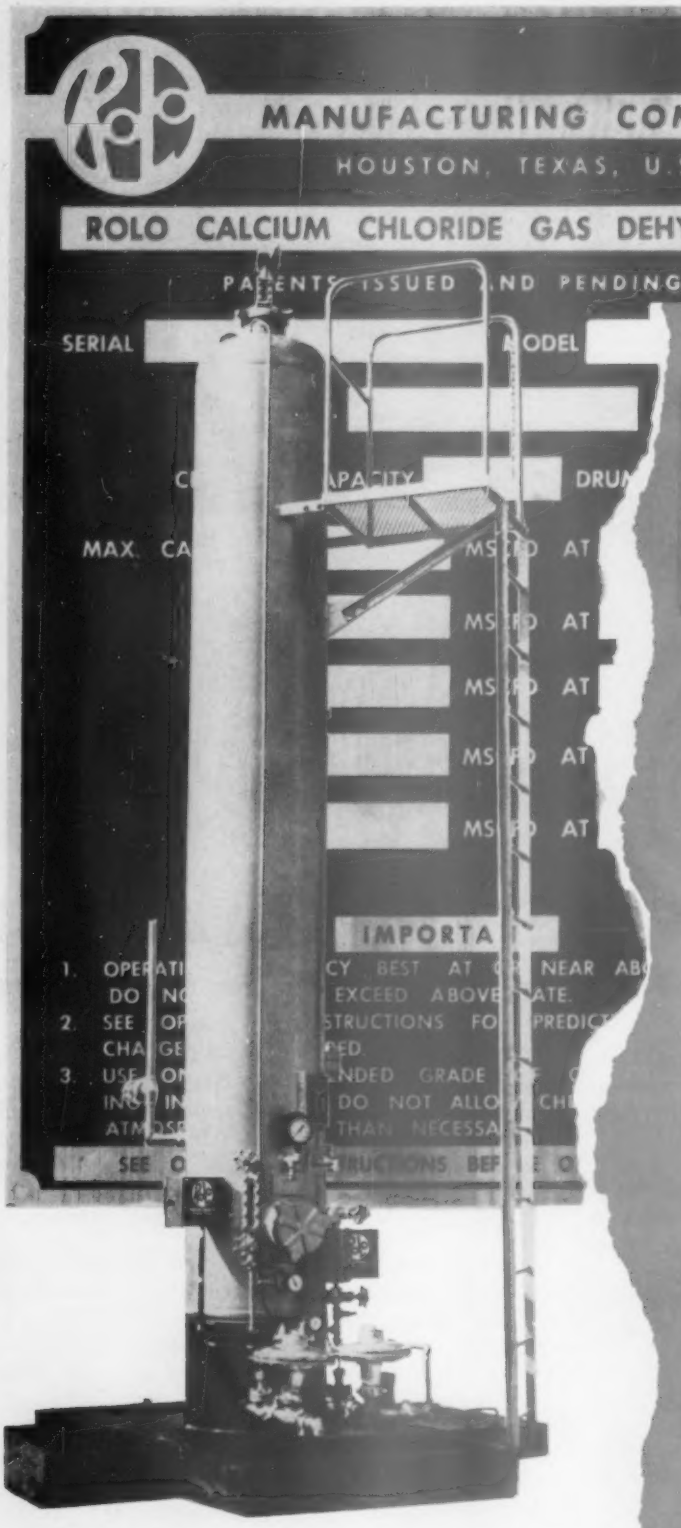
*Lasting* protection for your well requires lasting cement strength with low permeability. Investigate Silica Flour, another product development of Halliburton research . . . for cementing *any* well over 200° F. and for secondary recovery wells using steam or thermal drives.

. . . where advanced oil well cementing begins —through research!

**CEMENTING SERVICES**

**Halliburton**
COMPANY · DUNCAN, OKLAHOMA

# The




**ROLO CALCIUM CHLORIDE GAS DEHYDRATORS** provide lowest dewpoints with minimum operating and maintenance costs.

**ROLO OIL AND WATER METERS** provide consistently efficient, accurate production metering.

**ROLO METERING SEPARATORS** separate and meter production in the same vessel.

## Your guarantee of top perfor

The entire Rolo line of metering and dehydration equipment gives you high accuracy and dependability, along with years of service. Rolo, the world pioneer in metering equipment, produces metering and dehydration equipment for every oilfield need.

**ROLO OIL AND WATER METERS** have ultrasimple controls and few moving parts. Unmetered liquid cannot pass through the Rolo three-position valve. Rolo meters have no minimum rate. They are available in two lines: Rolocheck® meters with the accuracy required for royalty payments; Economy Line Meters with necessary accuracy for well-test data.

**ROLO WELLCHECKERS®** are skid- or trailer-mounted metering units for testing individual wells. These automatic units are operated in oilfields where conventional oil-gas separators are used.

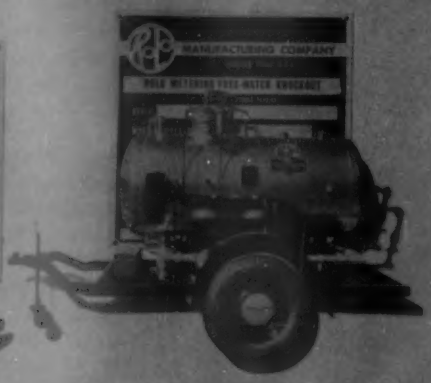
**ROLO METERING SEPARATORS** separate and meter production. These integral units cost less than individual separators and meters. Both two-phase (oil-gas) and three-phase (oil-gas-water) separators are available, with or without heaters.

**ROLO HI-CAP®** metering separators handle flow rates up to 50,000 bpd and meter crudes with viscosities higher than 100,000 SSU. They are available in both vertical and horizontal models.

**ROLO METERING TREATERS** use a thermostatically-

# ROLO emblem!

ROLO ACT SYSTEMS meet all requirements for accuracy and dependability in service.




ROLO METERING FREE-WATER KNOCKOUTS require no gas pressure to operate because they use pressure from the well pump to discharge liquids.

ROLO WELLCHECKERS® automatically separate and meter production, can be skid-mounted or trailer-mounted.

## ce from metering equipment, gas dehydrators, and ACT systems

controlled heater and a hay section to break emulsions. Oil and water are metered in the same vessel.

**ROLO METERING FREE-WATER KNOCKOUTS** are used where gas pressure is not available. Pressure from the well pump is used to discharge liquids. Units can be mounted on trailers or skids.

**ROLO CALCIUM CHLORIDE GAS DEHYDRATORS** give you *high efficiency*, reducing the dewpoint of outlet gas to a minimum. This efficiency results from combining Rolo's flow design with the dehydrating effectiveness of calcium chloride. Hundreds of Rolo dehydrators are now in the field meeting, and often exceeding, pipeline specifications for water content. Both initial cost and operating costs of Rolo dehydrators are low because expensive pumps and regeneration systems are eliminated and the costs of daily inspections and maintenance are avoided.

**ROLO ACT SYSTEMS** are guaranteed to meet all standards for accuracy and dependability. Rolo manufactures both positive-volume (dump-type) and positive-displacement systems. These units do not lose pump suction and do not allow gas to be blown down the line during pressure operation. Temperature compensation keeps accuracy high. Rolo ACT systems can be supplied in sizes to handle all flow rates. Individual meters or complete packaged systems can be provided.

Detailed specifications on all Rolo metering, dehydration, and other processing equipment are contained in our Condensed General Catalog. Ask your Rolo representative for a copy, or write to us at the address below.

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18 months during World War II off the coasts of New Britain and New Guinea. As I will always have the greatest respect for this little craft, I would like to see it get credit where credit is due.

Charles A. Sipes
Charles A. Sipes Well Service
Russell, Kans.

## A big blow? Well, hardly

Dear Sir:

With reference to your article on recovered sulphur in the April 17 issue (p. 71), we agree that such sulphur is having an impact on the world market but not in the degree and manner which some of your statements indicate.

The article begins by mentioning "the downward trend of prices" of sulphur. Actually, this trend has been reversed. In the past several months sulphur prices have risen in the foreign and certain domestic markets. The producers of recovered sulphur at Lacq, France, were the initiators of the foreign price advance late last year.

The author next practically writes off the Frasch producers: "Once the (U. S.) market was supplied primarily from Frasch sulphur mines along the U. S. Gulf Coast." It still is! Recovered sulphur has made a great percentage gain, but the tonnage is nevertheless far below Frasch sulphur tonnage. U. S. consumption of recovered sulphur in 1960 was less than 1,000,000 tons, compared with about 3,400,000 tons of U. S. Frasch sulphur.

Then the author says: ". . . the export market and certain large accounts that recovered can't handle are about the only remaining major outlets for Frasch sulphur." The fact is that Frasch sulphur accounted for 4 out of every 5 tons of elemental sulphur consumed in the U. S. in 1960. Excluding Mexican imports, U. S. Frasch alone accounted for 3.4 out of every 5 tons of elemental sulphur consumed.

Nor is the Frasch export market to be written off. The author says: Lacq "supplies most of the European consumers who formerly depended on the U. S." They still depend on the U. S. and very heavily so.

What happened in Western Europe was that total consumption of sulphur from all sources increased

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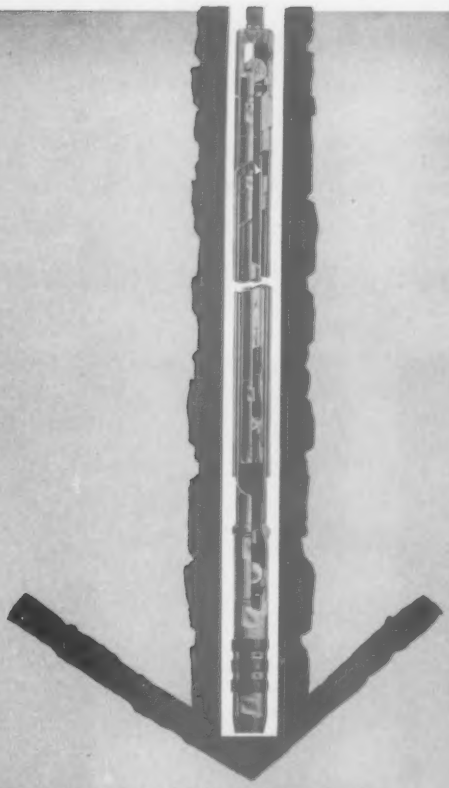

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during the 1957-60 period by almost 1,000,000 tons (from 6,100,000 tons to 7,050,000 tons). While Lacq sulphur accounted for over one half of the increase, all but one of the other sources shared in supplying the greater demand. The exception was pyrites, the major historical source of European sulphur, which remained virtually unchanged at 3,400,000 tons.

Consumption of U. S. Frasch sulphur in Europe was 675,000 tons in 1960 compared with 665,000 tons in 1957 when production began at Lacq. Total U. S. exports of Frasch in 1960 were at a record 1,700,000 tons. At the same time, consumption of Mexican Frasch sulphur in Europe rose from 215,000 tons in 1957 to 270,000 long tons in 1960. This record is hardly "a big blow to sulphur exporters."

J. C. Carrington
Vice President
Freeport Sulphur Co.
New York

*Editor's note: Frasch has the volume, but recovered sulphur is scoring the gains. Here are U. S. production and sales figures for the past 8 years:*

| | Production | | Sales (includes exports) | |
|---|---|---|---|---|
| Year | Rec. | Frasch | Rec. | Frasch |
| 1960 | 724 | 4,943 | 755 | 5,084 |
| 1959 | 651 | 4,554 | 688 | 5,186 |
| 1958 | 620 | 4,645 | 599 | 4,625 |
| 1957 | 519 | 5,491 | 481 | 5,005 |
| 1956 | 481 | 6,427 | 482 | 5,672 |
| 1955 | 402 | 5,743 | 400 | 5,790 |
| 1954 | 357 | 5,516 | 356 | 5,310 |
| 1953 | 337 | 5,155 | 324 | 5,202 |

(Figures in thousands of tons.)

**Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.**

# CALENDAR

**MAY**

**28-June 2** Special Libraries Association, petroleum section meeting, San Francisco.

**JUNE**

**1** American Chemical Society, Southwest Louisiana section, and American Institute of Chemical Engineers, Southwest Louisiana section, sixth joint technical conference, McNeese State College, Lake Charles, La.

**1-2** Kentucky Oil and Gas Association, annual meeting, Phoenix Hotel, Lexington.

**1-3** Interstate Oil Compact Commission midyear meeting, Shamrock-Hilton Hotel, Houston.

**5-6** Petroleum Electric Power Association, meeting, Mayo Hotel, Tulsa.

**6-8** Instrument Society of America, summer instrument-automation confer-

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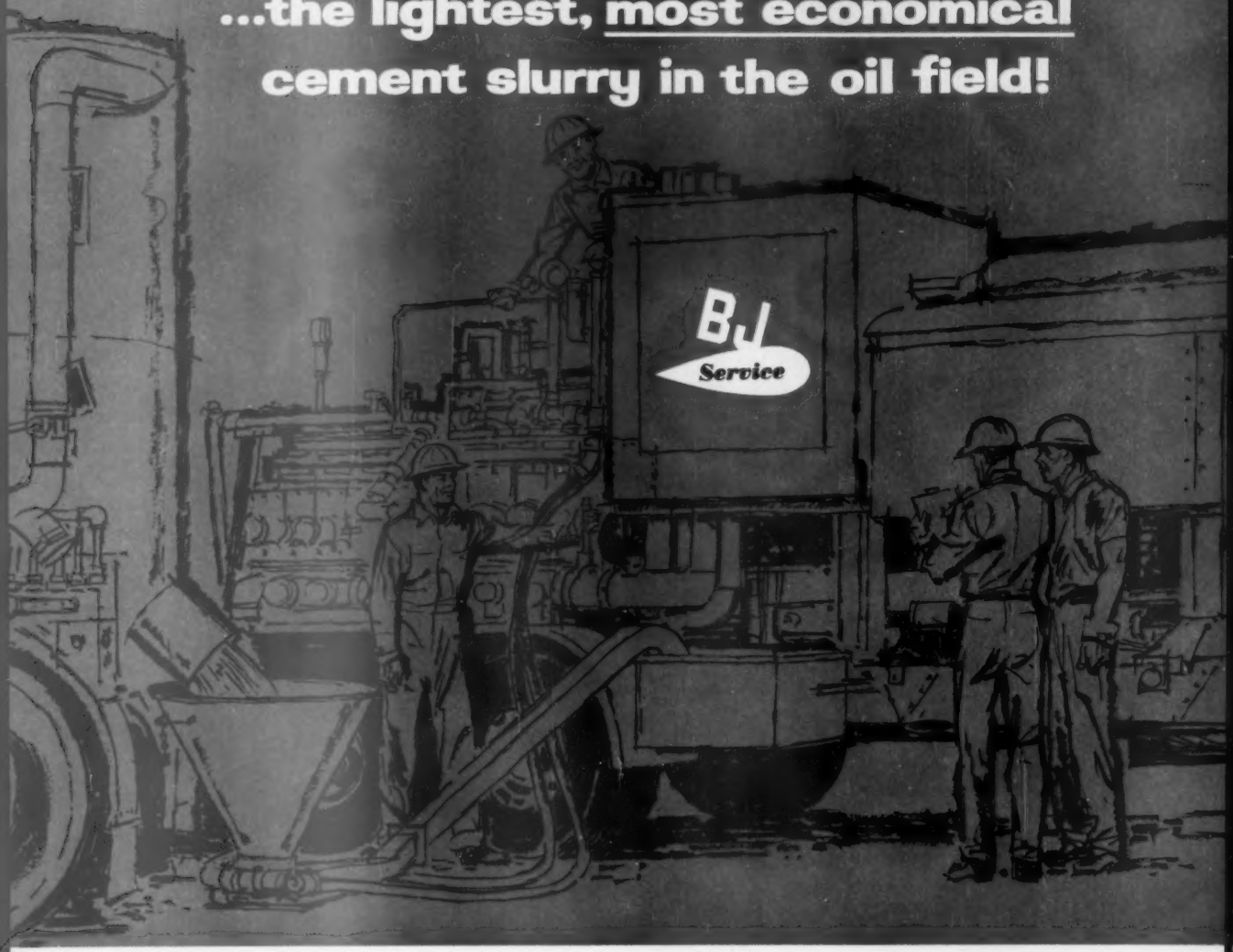


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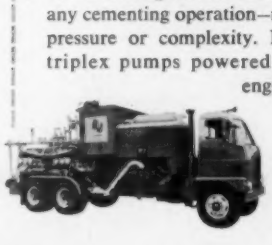

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| 4½" | 9.5 lb. | 7" | 20 — 38 lb. |
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ence and exhibit, Royal York Hotel and Queen Elizabeth Hall, Toronto.

6-8 Sixth annual Appalachian underground corrosion short course, West Virginia University, School of Mines, Morgantown, W. Va.

9-17 European Congress of Chemical Engineering and Achema Congress, thirteenth exhibition and congress of chemical engineering, Frankfurt am Main, Germany.

11-15 American Society of Mechanical Engineers, summer annual meeting, Statler Hilton Hotel, Los Angeles.

11-16 American Petroleum Institute, Division of Production, midyear committee conference, St. Francis Hotel, San Francisco.

12 Instrument Society of America and Air Pollution Control Association, air pollution instrumentation symposium, Hotel Commodore, New York City.

12-14 American Petroleum Institute, Division of Transportation, annual tanker conference, Oyster Harbors, Cape Cod, Mass.

12-16 Gordon Research Conferences, petroleum, Colby Junior College, New London, N. H.

13-16 Instrument Society of America, biennial international gas chromatography symposium, Kellogg Center, Michigan State University, East Lansing, Mich.

19-23 Harvard University, School of Public Health, air cleaning institute, Cambridge, Mass.

19-23 Gordon Research Conferences, catalysis, Colby Junior College, New London, N. H.

20-22 National Association of Corrosion Engineers, Greater Boston section, corrosion short course, Wentworth Institute, Boston.

20-24 Canadian Gas Association, annual meeting, Banff Springs, Alta.

21-24 American Association of Petroleum Landmen, annual meeting, Shamrock-Hilton Hotel, Houston.

25-30 American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City,, N. J.

26-27 Michigan Gas Association, annual meeting, Grand Hotel, Mackinac Island, Mich.

26-July 7 Massachusetts Institute of Technology, summer program on dynamics and control of chemical engineering processes, Cambridge, Mass.

28-30 International Gas Conference, Stockholm, Sweden.

28-30 Instrument Society of America, joint automatic control conference, Boulder, Colo.

**JULY**

4-7 National Society of Professional Engineers, twenty-seventh annual meeting, Olympic Hotel, Seattle.

6-8 International Oil Scouts Association, annual meeting, Roosevelt Hotel, New Orleans.

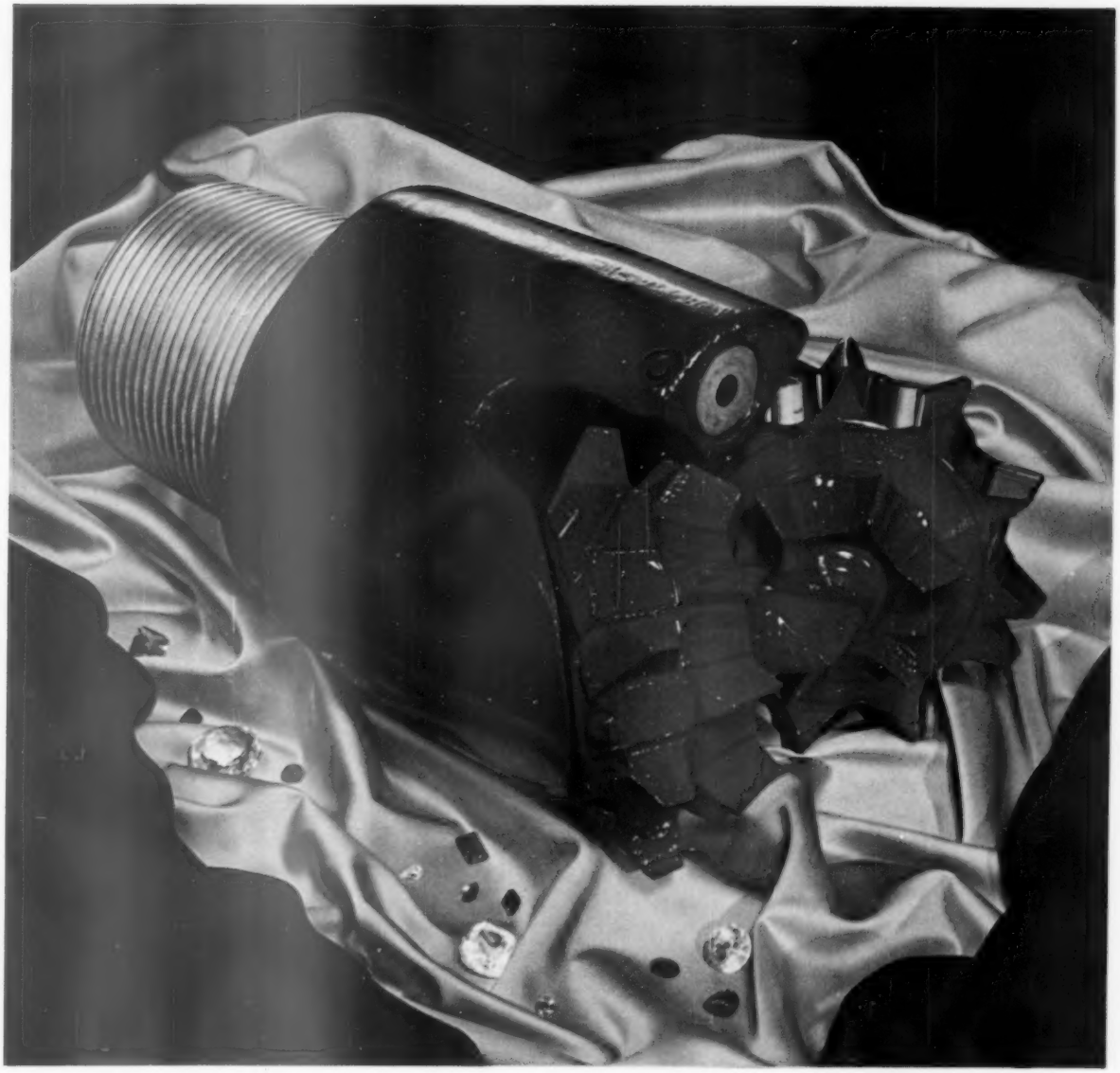
10-21 University of Michigan, summer course on underground storage of natural gas, Ann Arbor, Mich.

26-28 American Petroleum Institute, Division of Production, eastern district meeting, The Greenbrier, White Sulphur Springs, W. Va.

27-29 Rocky Mountain Mineral Law Foundation, seventh annual institute, University of New Mexico, Albuquerque.

**AUGUST**

2-4 Wyoming Geological Association, six-



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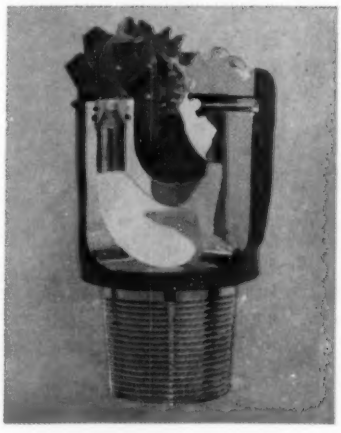

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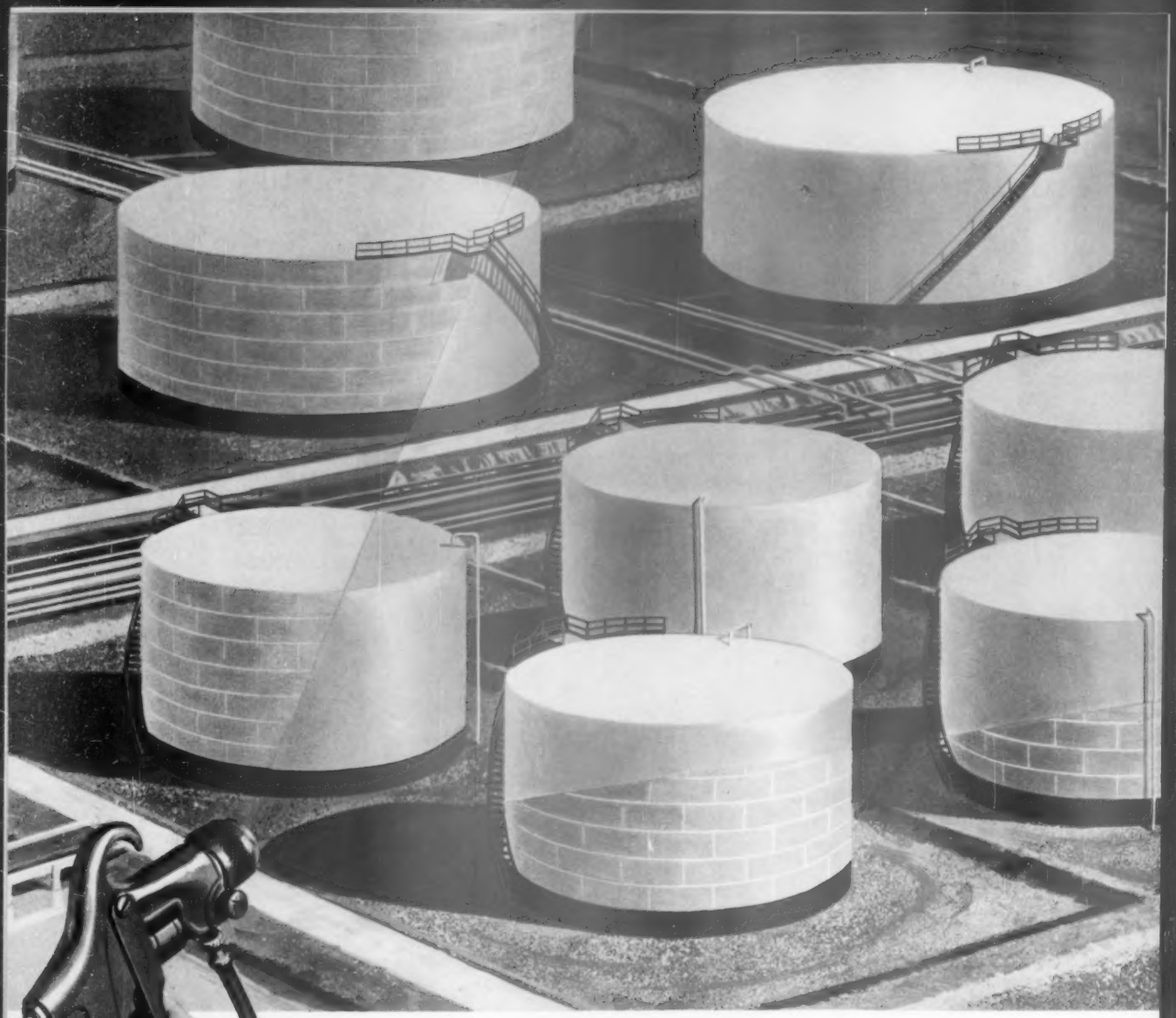

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28-Sept. 1 American Society of Mechanical Engineers, international heat transfer conference, Boulder, Colo.

**SEPTEMBER**

5-8 American Chemical Society, Chicago section, eleventh national chemical exposition, International Amphitheatre, Chicago.

7-9 Magic Plains Oil Exposition, Borger, Tex.

11-15 Instrument Society of America, fall instrument - automation conference and exhibit and sixteenth annual meeting, Biltmore Hotel and Memorial Sports Arena, Los Angeles.

12-13 American Gas Association, Southern Gas Association, annual accident prevention conference, Statler Hilton Hotel, Dallas.

13-15 Pacific Coast Gas Association, convention and annual meeting, Coronado Hotel, Coronado, Calif.

13-15 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual meeting, Rossevelt Hotel, New Orleans.

13-15 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

14 Natural Gasoline Association of America, Rocky Mountain regional meeting, Northern Hotel, Billings, Mont.

15-16 Kansas Geological Society, annual field conference, Mark Twain Hotel, Hannibal, Mo.

17-20 American Institute of Electrical Engineers, annual electrical conference of the petroleum industry, Jung Hotel, New Orleans.

18-19 Independent Natural Gas Association of America, annual meeting, Shamrock Hilton Hotel, Houston.

20-21 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

24-27 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Muehlebach Hotel, Kansas City.

25-27 Texas Mid-Continent Oil and Gas Association, annual meeting, Texas Hotel, Fort Worth.

**OCTOBER**

1-4 American Gas Association, annual convention, Dallas.

3-4 University of Kansas, ninth annual gas measurement institute, National Guard Armory, Liberal, Kans.

4-6 American Association of Oilwell Drilling Contractors, annual meeting, Rice Hotel, Houston.

4-6 American Society of Mechanical Engineers, process-industries conference, Shamrock-Hilton Hotel, Houston.

8-11 Society of Petroleum Engineers of AIME, annual fall meeting, Memorial Auditorium, Dallas.

11-12 Western Petroleum Refiners Association, waste disposal and stream pollution conference, Hotel Lassen, Wichita.

12-13 California Natural Gasoline Association, annual fall meeting, Lafayette Hotel, Long Beach, Calif.

15-17 National Association of Oil Equipment Jobbers, annual convention and trade show, Mayflower Hotel, Washington.

17-19 American Society of Mechanical Engineers, American Society of Lubricating Engineers, lubrication conference, Morrison Hotel, Chicago.

18-20 Rocky Mountain Oil and Gas Association, annual convention, Denver-Hilton Hotel, Denver.

18-21 American Association of Petroleum Geologists, Mid-Continent regional meeting, Amarillo, Tex.

25-26 Western Petroleum Refiners Association, annual question and answer session on refining technology, Rufus Garrett Hotel, El Dorado, Ark.

27 Natural Gasoline Association of America, southern regional meeting, Carlton Hotel, Tyler, Tex.

29-31 Independent Petroleum Association of America, annual meeting, Shamrock-Hilton Hotel, Houston.

29-Nov. 1 National Lubricating Grease Institute, annual meeting, Rice Hotel, Houston.

**NOVEMBER**

1-3 Southwest Federation of Geological Societies, annual meeting, El Paso, Tex.

2-3 Society of Petroleum Engineers of AIME, annual California regional meeting, Hacienda Motel, Bakersfield, Calif.

5-9 Society of Exploration Geophysicists, international meeting, Denver.

6-8 Chemical Institute of Canada, conference of the chemical engineering division, Royal York Hotel, Toronto.

13-15 American Petroleum Institute, forty-first annual meeting, Conrad-Hilton, Congress and Palmer House hotels, Chicago.


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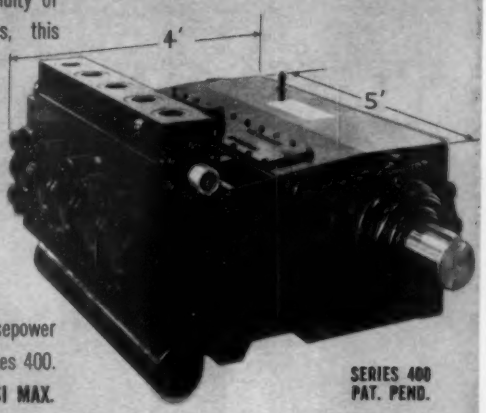


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To that effort, Tex-Tube has inaugurated a Research and Development program calculated to match anything offered in the industry.

This Research and Development program at Tex-Tube has two very tangible benefits for you—

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The photographs here show just 12 of the quality control steps through which Tex-Tube pipe goes including our metallurgical laboratory, our chemical analyses, our in-line control check points.

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## 50 years ago

June 1, 1911

The state land board of Colorado is investigating reports of the discovery of oil in Montezuma County, in the southwestern corner of the state. The reported discovery is near state land along the Utah-Colorado boundary.

A leading scientific magazine states that the idea of obtaining gasoline from natural gas, or liquefying gases is not new as some oil and gas men now think. A process similar to that being followed in some of the plants springing up in several gas-producing areas was described in the 1870's by a Scotch scientist in a treatise on "Mechanical Refrigeration."

Vinton field, in southwestern Louisiana, is hit by a sudden violent wind and rainstorm that swept clean all 61 derricks, all small buildings, and stacks off all boilers in the field.

## 25 years ago

May 28, 1936

One of the most extensive and elaborate geophysical exploratory programs ever undertaken on the Gulf Coast is being launched jointly by Salt Dome Oil Co. and the California Co. in Galveston Bay, the largest inland body of water on the coast untouched so far by oil exploration.

The long search for deep oil and gas production in the old Cement area of Caddo County, Oklahoma, was rewarded this week by a well flowing 500 bbl. and M.M.c.f.d. of gas from a 6,367-ft. sand, believed to be in the Pennsylvanian series.

## 10 years ago

May 31, 1951

Cities Service Oil Co. has joined with Firestone Tire & Rubber Co. to form American Petro-Chemical Corp. for the manufacture of essential petroleum-derived chemicals. A site at Lake Charles is under consideration for the construction of a large modern plant which will ultimately produce plastics, lubricating-oil additives, cracking catalysts, antifreeze and many high-volume petrochemicals. Each company has a half interest in the new enterprise.

Construction is under way at Birkenhead, England, on two $4,200,000 tankers for Standard Vacuum Oil Co. The first to be built in England for the Standard fleet, the ships will be among the world's largest and fastest tankers. They are the first of six ordered by Esso Petroleum Co., British affiliate of Standard.

Cuban Oil Co. starts its second Cuban offshore test in the Bay of Cadiz, 50 miles east of the first well, in the Bay of Cardenas, on the north coast of Cuba. Operations are from a platform. The first test went to 5,045 ft.

# JOURNALLY SPEAKING

## National Nuts Policy

WHEN A MAN with a PhD in economics takes such a lighthearted and bemused approach to a research project that he presents his thesis in the form of a funny fable, the event is significant news—at least to this department.

Such a one is Dr. Bruce C. Netschert, author of a couple of authoritative books (the latest one 3 in. thick) on the nation's fuel resources. Because he is such an expert on the subject, TIPRO invited him to address its annual meeting and tell the Texas producers what to expect from the proposed national fuels-policy study that has everybody so excited.

The audience braced itself for a long-haired economic dissertation, but to its surprise and delight Dr. Netschert's analysis went something like this:

"Once upon a time there was a happy and prosperous nation of squirrels. Their chief product was nuts, and they were bountifully supplied with nut resources. They had kola nuts, they had piñon nuts, and they had natural-cashew nuts.

"But the nut producers were not happy. They were bothered by competition from imports of piñon and residnuts. The kola producers were losing their market to cashews. And the producers of piñon and cashew (which were often found on the same tree) complained that they had to roam farther to find good groves and climb higher on the trees to gather as many nuts as before. Also they were allowed to pick piñons in some trees only a few days each month.

" 'How do you expect us to be bright-eyed and bushy-tailed,' the nut producers asked other squirrels, 'when things are as they are?'

"Things might have gone along this way indefinitely had not the kola producers suddenly startled the other nut producers out of a year's growth of fur. 'The solution,' said the kola producers, 'is a National Nut Policy.' And they promptly set to work to have the National Squirrel House make such a study.

"The other nut producers were alarmed. 'What you really mean,' the cashew producers shouted, their tails twitching in anger, 'is that cashew nuts shouldn't be eaten by all squirrels. This is a trick to get cashews restricted to old squirrels who have lost their teeth and can't eat the hard nuts.'

"However, the National Squirrel House did conduct a National Nut Study. It took a long time, but eventually it was released. And again a wave of shock went through the nuts industry, this time including the kola producers.

"The study simply recommended that certain nut policies be retained and others changed somewhat. It also proposed a few radical changes worked up by the staff, but these were buried inconspicuously in technical appendixes to the report and were overlooked by most squirrels, as they were intended to be.

"What dismayed each of the producer groups was that they had secretly hoped and expected to get some advantage over the others. But the report left them still at a standoff with each other. So all the nut producers were unhappy again, but this time for different reasons.

"Moral: There's no fuel like an old fuel."

Dr. Netschert added the cautious disclaimer that he was not implying that any fuels producers are squirrelly or that a national fuels policy is nuts.

His contention was that nobody needs to fear much or expect much from a congressional study of the fuels industry.

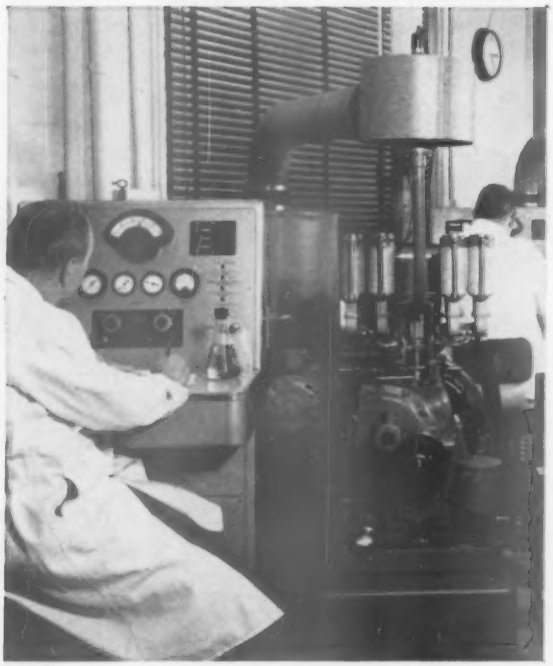
Because, practical politics being what it is, when it gets right down to the nut-dividing point, Congress just isn't going to upset a lot of applecarts or do anything drastic to give one fuel a deliberate advantage over another.

The good doctor may have something there.

*—Henry D. Ralph.*

# WHICH ANTIKNOCK AND HOW MUCH?

**1.** In one of Ethyl's five gasoline testing laboratories, customers' gasolines are blended with TEL, TML, "MLA" (mixed lead alkyls), and "TELMEL" (physical mixtures of TEL and TML), in concentrations ranging from 1.06 to 3.17 grams of lead per gallon.



**2.** Each sample is rated for Research and Motor octane number. In addition, distillation, vapor pressure, sulfur, gravity, and percentage aromatics, olefins and saturates are determined. Altogether, each sample is subjected to over 80 separate tests.

**5.** The report is discussed with the refiner. Here C. A. Cole, Chief Refinery Technologist, in the Eastern Region, and D. J. Chapman, National Account Representative, point out highlights of such a study.

**6.** When the laboratory work indicates a potential gain from changing antiknocks, tests of selected gasolines are made on Ethyl's controlled-weather chassis dynamometers in Detroit.

**3.** A comprehensive computer program, designed by Ethyl's Dr. W. C. Healy, Jr., shows cost effectiveness of each antiknock at each concentration for a range of given octane numbers, as well as octane numbers obtainable for a range of costs.

**4.** The results of each customer program are thoroughly reviewed by Ethyl's Refinery Technology Division at the Detroit Research Laboratories. Here T. W. Warren and L. E. Stinson put the final touches on the assembled data.

## HERE'S ETHYL'S ANSWER: *An expanded service that matches gasoline composition and antiknock... helps to blend fuels that meet the individual refiner's needs at lowest cost.*

Having many antiknocks to choose from gives refiners a new opportunity to improve gasoline performance and/or save money on refining costs. However, they add a complicating element to an already complex problem—how to achieve optimum balance between refinery processing and antiknocks. In Ethyl's view, refiners should be able to look to their antiknock supplier for help in solving this problem.

Ethyl's service rates eight "Ethyl" antiknocks in customers' gasolines, to establish the relative benefits of each at varying concentrations. The photographs illustrate this service. For further information on Ethyl's wide range of antiknock compounds, and the complete line of services that go with them, call your Ethyl Representative.

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**For the latest practical knowledge of how to use Baker Retainer Production Packers, call your Baker Representative.**

**THE DOUBTS** that harass well operators got a real body blow when the now-celebrated Baker Retainer Production Packer was developed some years ago.

This is probably the most predictable (and certainly the most respected) packer ever to go into an oil well. It commands the respect and confidence of operators the world over.

**WHAT'S THE SECRET** of building a packer so tough and reliable you know it will keep you honest when you recommend it?

For one thing, it takes time—years of performance studies. We've sweated out failures and assessed our successes—sifted out weak points and strengthened the strong points.

This great packer is at work right now in tens of thousands of wells—the average wells, the corrosive wells, the deep, hot, high pressure wells.

**THAT'S A TOUGH** proving ground—one that has helped us soak up a vast knowledge of what happens to slips, packing elements, and the like, when a packer is downhole. We've got the facts.

Baker made the first retainer packer—for many years the *only* retainer-type packer. The result is a wealth of packer experience that's hard to equal.

This remarkable packer shows it. Over the years we've refined it into a tool that has unyielding stamina. That's why we can call it the most predictable packer of them all.

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# Bad pricing policies are oil's greatest weakness

FINANCIAL ANALYSTS are expressing doubt that oil-company earnings the rest of this year will be anywhere near as good as they were in the first quarter. So are some company executives.

The reason is the deteriorated price structure. Wholesale prices of refined products have dropped 5% since mid-March. Further declines were posted last week. Gasoline price wars are rampant all over the map.

The blame does not lie heavily with the industry's statistical position. The fault is chiefly that the industry doesn't know how to sell its products at a profit.

Demand is fairly good. A late spring in many areas has delayed the usual seasonal rise in gasoline use, but the forecast is still for a higher volume of sales than last year.

Refinery runs have been held down remarkably well during the past couple of months. Product stocks are a little on the high side but not burdensomely excessive. There is little really distress gasoline in the spot market. Yet refiner-marketers are acting as in a panic.

It was beginning to look as though the producing and refining branches of the industry had learned to adjust to changed conditions, to operate within the framework of current economic circumstances. But obviously the marketing branch hasn't learned yet.

There is growing realism toward over-all market demand but very little toward how to make money selling gasoline. Top executives—as well as every individual in the oil business—should realize that there are no earnings for the industry unless its products are marketed at a profit.

Marketers are overly scared at price competition, unreasoningly determined not to lose gallonage even temporarily, unmindful that there is no gain in selling thousands of gallons or even one gallon without a profit.

They advertise quality and service, but give the lie to it by meeting every fly-by-night price cutter. This conditions motorists to be purely price conscious and to consider price-war levels as just and proper.

MANY NEW EXPERIMENTS in marketing and pricing plans are being tried by various companies in an attempt to keep price wars from spreading. They have theoretical merits, but at best they are treating only symptoms.

None of these plans will work unless backed up by a determination to follow a realistic pricing policy: one that plays fair with every link in the distribution chain, that seeks a profit on every gallon turned over, that isn't a maze of erratic and discriminatory variations, and that doesn't break in panic at every unsettling market rumor.

It will be hard to restore price levels this summer. But unless the debacle is cleaned up the whole industry will look pretty sick.

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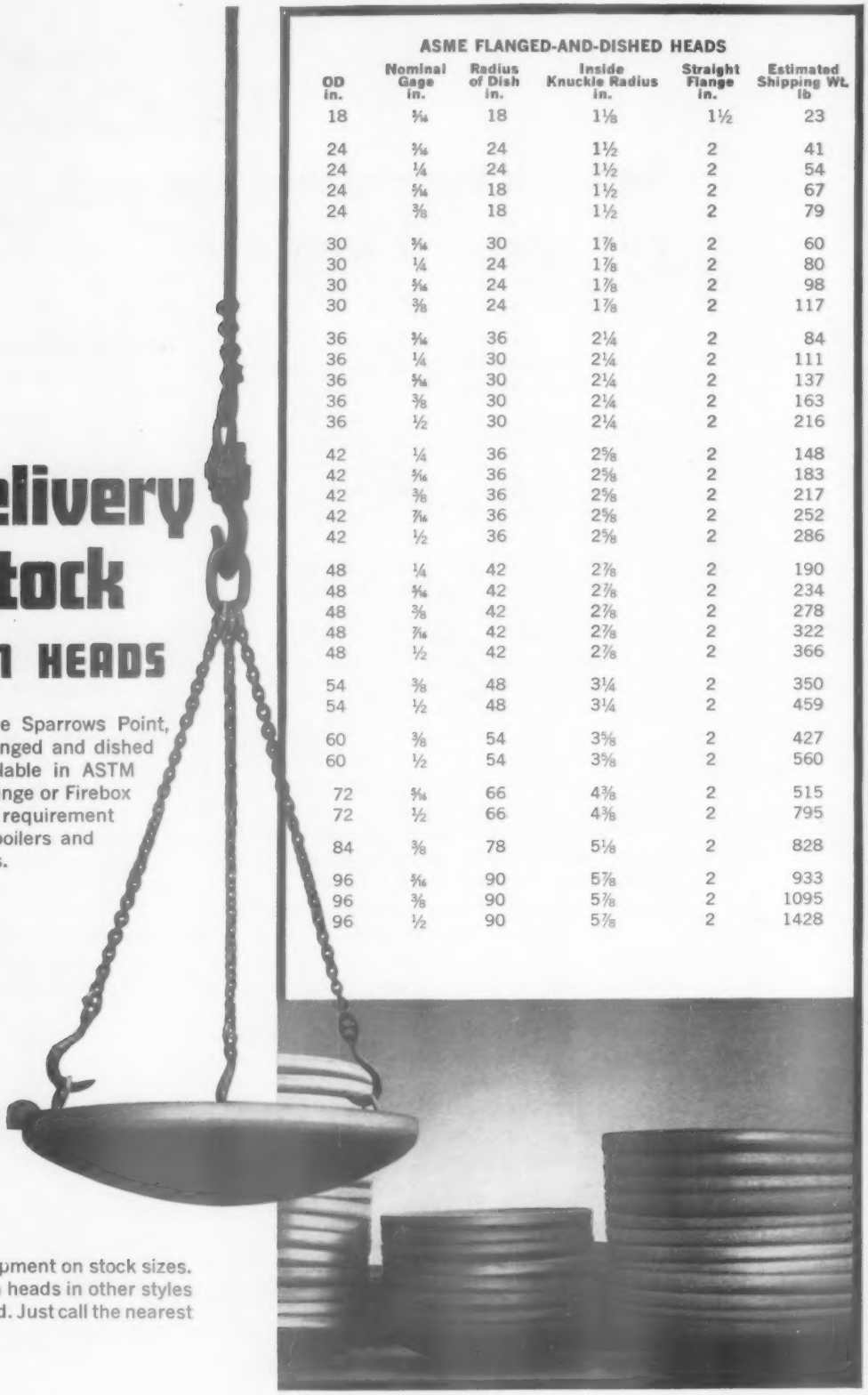
|---|---|---|---|---|---|
| 18 | 3/16 | 18 | 1 1/8 | 1 1/2 | 23 |
| 24 | 3/16 | 24 | 1 1/2 | 2 | 41 |
| 24 | 1/4 | 24 | 1 1/2 | 2 | 54 |
| 24 | 5/16 | 18 | 1 1/2 | 2 | 67 |
| 24 | 3/8 | 18 | 1 1/2 | 2 | 79 |
| 30 | 3/16 | 30 | 1 7/8 | 2 | 60 |
| 30 | 1/4 | 24 | 1 7/8 | 2 | 80 |
| 30 | 5/16 | 24 | 1 7/8 | 2 | 98 |
| 30 | 3/8 | 24 | 1 7/8 | 2 | 117 |
| 36 | 3/16 | 36 | 2 1/4 | 2 | 84 |
| 36 | 1/4 | 30 | 2 1/4 | 2 | 111 |
| 36 | 5/16 | 30 | 2 1/4 | 2 | 137 |
| 36 | 3/8 | 30 | 2 1/4 | 2 | 163 |
| 36 | 1/2 | 30 | 2 1/4 | 2 | 216 |
| 42 | 1/4 | 36 | 2 5/8 | 2 | 148 |
| 42 | 5/16 | 36 | 2 5/8 | 2 | 183 |
| 42 | 3/8 | 36 | 2 5/8 | 2 | 217 |
| 42 | 7/16 | 36 | 2 5/8 | 2 | 252 |
| 42 | 1/2 | 36 | 2 5/8 | 2 | 286 |
| 48 | 1/4 | 42 | 2 7/8 | 2 | 190 |
| 48 | 5/16 | 42 | 2 7/8 | 2 | 234 |
| 48 | 3/8 | 42 | 2 7/8 | 2 | 278 |
| 48 | 7/16 | 42 | 2 7/8 | 2 | 322 |
| 48 | 1/2 | 42 | 2 7/8 | 2 | 366 |
| 54 | 3/8 | 48 | 3 1/4 | 2 | 350 |
| 54 | 1/2 | 48 | 3 1/4 | 2 | 459 |
| 60 | 3/8 | 54 | 3 5/8 | 2 | 427 |
| 60 | 1/2 | 54 | 3 5/8 | 2 | 560 |
| 72 | 5/16 | 66 | 4 3/8 | 2 | 515 |
| 72 | 1/2 | 66 | 4 3/8 | 2 | 795 |
| 84 | 3/8 | 78 | 5 1/8 | 2 | 828 |
| 96 | 5/16 | 90 | 5 7/8 | 2 | 933 |
| 96 | 3/8 | 90 | 5 7/8 | 2 | 1095 |
| 96 | 1/2 | 90 | 5 7/8 | 2 | 1428 |



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# Can Drilling Crew Quality Be Kept Up?

**• It's already hard to keep good crew members. The reason: Idle rigs have meant less work and income for the contractor and crews. Some doubt the industry could man its rigs if drilling activity took a sharp rise.**

DRILLING labor is approaching the status of a scarce commodity.

In fact, if rig activity should pick up appreciably, contractors would face the threat of a labor shortage.

That's the consensus of drilling contractors who talked to Journal editors during a special survey of labor conditions in the drilling industry.

Contractors report at present they are able to man their crews, although many experienced derrickmen, floormen, and even drillers have left the industry. The workers can get better jobs in defense plants or industry.

**Why the shortage? . . .** Contractors blame lack of work, comparatively poor pay, and tougher working conditions for the gradual drift of workers from the derrick.

Idle rigs have plagued the drilling industry for a few years now. Rig activity last year was the smallest for a peace-time year since the mid-1930's. The average activity so far this year is even lower.

Less work for the contractors means less income. This trend is aggravated by the tendency of many contractors to shave their footage prices. And it all adds up to less work and less income for the crews.

The plight of the drilling contractor is widely known in the industry, but less well known is what's happening to drilling labor.

Here's a sampling of comment on labor conditions:

A Midland, Tex., drilling-firm executive says flatly, "We all would be hard pressed to find capable crewmen if activity were to increase much."

He doesn't see much chance of drilling picking up, however, until Texas allowables move back up to at least 12 producing days. This rig inactivity has been a greater factor for the drift of crewmen into other occupations than low wages, he says. The wage scales are much lower than they should be, and the drilling industry continues to suffer by comparison with other crafts and occupations in the area.

An Abilene, Tex., contractor reports he already sees signs of trouble getting good men if activity picks up. On his last well, for instance, the Texan said only two of the three drillers who had formed the crews for the rig would come back to work.

A Wichita Falls, Tex., contractor who has all his 16 rigs busy at the moment, is having trouble keeping competent crews in the Panhandle-Hugoton area. Rig jumping is quite common.

Some contractors have raised wages 5 to 10 cents an hour in an effort to attract good crewmen, but the shortage still persists.

In Tulsa, a five-rig contractor says he has had no trouble retaining his key men but is having difficulty filling out his crews with good new men.

The executive of a larger Tulsa contracting firm reports, "We're losing what good hands we have just about every week. We can hold our crews for deeper wells, but for shallow wells in the Oklahoma Panhandle or Kingfisher area our crew members are just pickups. There's never been a time when it was as tough to keep good crews together."

A contrary trend is experienced by one Tulsa firm which manages to keep its equipment busy. It has had no problems keeping crews.

Another reports it is flooded with applications of competent men desiring to work abroad. A third says getting crews for its offshore rigs is no problem. But the case of each is not typical.

A Houston contractor makes this comment: "We have seen the labor force in drilling become less and less experienced in the last 2 or 3 years. It hasn't reached the point generally yet where the work of crewmen is not good enough but the trend is in that direction."

Another veteran Houston contractor says: "Low wages have lowered the caliber of men. I know we don't have as high a caliber as we had 15 to 20 years ago." Another comment: "If the industry needed 2,500 rigs, I don't know where we would find the men to run them—we could find the rigs but not the men."

**West Coast . . .** Lack of work rather than low wages is the reason drilling workers are leaving the industry in California.

If there were more work available, most contractors feel they could keep personnel by being able to offer them steady work. But working in spurts has caused many to leave the field.

Most of the men leaving the industry are rotary helpers and roughnecks rather than drillers and toolpushers. And there is virtually no inducement for the young man who wants to break into the drilling business.

This high turnover in the lower drilling jobs has forced contractors to hire inexperienced help which

## What Drilling Crew Members Make in Six Areas

| | Drillers (Hourly) | Derrickmen (Hourly) | Motormen (Hourly) | Floormen (Hourly) | Tool Pushers (Monthly) |
|---|---|---|---|---|---|
| California | $4.21 | $3.30 | $3.12 | $2.96 | $840-890 |
| Rockies | $2.72-3.05 | $2.06-2.50 | $2.06-2.50 | $1.96-2.50 | $700-865 |
| Oklahoma-Kansas | $2.56-2.86 | $1.90-2.50 | $1.90-2.10 | $1.90-2.10 | $800-850 |
| West Texas-New Mex. | $2.35-2.87 | $1.95-2.50 | $1.95-2.50 | $1.95-2.50 | $800-850 |
| Gulf Coast | $2.58-2.75 | $1.85-2.50 | $1.96-2.16 | $1.96-2.10 | $800-850 |
| Williston Basin | $2.90 | $2.20 | $2.18 | $2.06 | $850 |

admittedly is not the same caliber drilling personnel found in good times when steady work is available.

Most West Coast contractors gave 5% wage increases annually until this year. The increases in 1961 generally have been limited to union personnel.

The pay scale in California always has been about 20% above the Mid-Continent level. This is due to the general high-wage scale on the coast and the higher cost of living.

All the contractors point to the danger which would arise if there were a big upsurge in business and a sudden demand for more rigs. They say there wouldn't be enough experienced help available.

**The outlook . . .** Any basic solution of the drilling industry's labor problems rests with a pickup in rig activity and footage rates.

Contractors are very pessimistic on the chances for any economic upswing for them soon. The worldwide oversupply of crude will tend to keep restraints on production and discourage drilling.

Many contractors warn that the day isn't far off when the companies will be forced to pay higher rates to obtain good equipment and competent crews or be prepared to drill their own wells.

An outspoken Tulsa contractor said the problem rests squarely with the oil companies. He adds: "They are just going to have to help the contractors increase income so they can pay higher wages."

He terms "the short sightedness of management in the major oil companies as amazing and ultimately they will pay for turning their backs on those who are drilling for their oil."

Another Tulsan observes, "I don't see any answer to our problem right now—it may be companies will just have to begin drilling their own wells with their own crews."

A Houston contractor pleads for understanding and coordination of efforts by companies and the contractors. "The operators must realize the risk involved for the contractor and should let him make a little money," he says.

**What's needed . . .** Meanwhile, other steps needed to upgrade drilling labor are higher wages and more training which would attract younger men into the business and prepare them for competent work.

Many contractors have given no pay raises in the last 2 years. As a result one New Orleans contractor says flatly a wage raise of 25 to 50% may now be needed to attract qualified people into drilling.

This company plans a 4 to 5% raise soon with a new scale giving weight to length of service with the company. "We are trying to give the men the security they never knew before," an official of the company comments.

This company, however, is more able to keep crews permanently than other contractors because it has its own exploration business and uses rigs which are waiting for a contract to perform company drilling.

"I don't propose that everyone follow our example," the official says. "But the producers are forcing us to get into their own end of the business."

The vast majority of contractors, however, report they just can't increase their labor costs with a pay raise and still stay in business.

Contractors have been forced to absorb nearly all their past pay increases, but they have reached the point now where this is impossible under the footage-rate structure.

Some contractors feel the low wage scale is expensive because of less efficiency and worsening safety records.

One contractor recently paid out $7,500 for an injury suffered by a drilling crew member. Part of the blame for the accident, he reported, could be traced to five different crewmen.

Another contractor is considering offering his crews a safety bonus for each 3-months worked without an accident.

The cost of inefficiency can make itself felt in many other subtle ways. If it takes a week longer to drill a well, one contractor pointed out, that means a week of more mud and a week less production for the company. It means a week's more wage and operating costs for the drilling contractor.

The efficiency aspect, however, can be met by special training. The American Association of Oil Drilling Contractors is trying to help the industry in this area with a series of short courses.

But the only real solution to drilling labor problems will come when contractors can put more of their rigs to work at rates which will allow them to raise wages.

# Ancient Fields Still Adding to Reserves

**• And that's something, suggests NPC's report on productive capacity, that pessimists should keep in mind when they predict the year in which we'll run out of oil. Too, there's no pattern for predicting future oil supplies.**

THE RECENT report by the National Petroleum Council to Interior Department on proved discoveries and productive capacities should be required reading for those who fear that this nation is running out of oil.

The report itself, prepared by the NPC's Committee on Proved Petroleum and Natural Gas Reserves and Availability, is a factual, statistical study. It was not intended to prove or disprove any pet theory about this nation's supply of oil.

However, the committee's explanation of the figures it supplies enables the reader to put the statistics in their proper perspective and to use them with some understanding.

Take the matter of recoverable reserves. The uninitiated are often inclined to take estimates of U. S. reserves, add the rate of new discoveries, divide the total by the annual rate of consumption, and arrive at the conclusion that in X years this nation will be out of oil.

Or, as Interior Department officials apparently felt at the time they gave the NPC the assignments more than a year ago, if you assign known reserves to their year of discovery, you can discern a pattern or trend of discoveries that will help in estimating future supply.

The NPC committee, in its carefully-worded report, makes it clear that such approaches can be misleading.

The committee warns that anyone using the tabulation of data arranged by discovery wells (see table on next page) should bear in mind that these data do **not** measure discovery trends.

In fact, the tabulation is not even a valid measure of the amount of oil already discovered. The reason: There are constant revisions—most of them upward—of previous estimates for any given field. These revisions continue for many years.

Thus, in the discovery-year tabulation for crude, fields discovered in 1954 have been credited with only 5 years of revisions, whereas those discovered earlier have been revised over a period up to 40 years or more.

Revisions are usually sharper in the early years, but they are still being made in fields with a long productive history (see box).

Therefore, the committee reasons, "the aggregate of all fields heretofore discovered . . . represents an enormous base for future additions to reserves through further extensions and revisions."

But just as there is danger in underestimating the amount of oil eventually recoverable, there is also danger in assuming that future reserve estimates will continue to increase "automatically" with the passage of time.

The committee makes it clear there is more to it than this.

Other factors, in addition to time, are intensity of effort in the search for oil and in technologic development and its application through improved recovery methods.

"The intensity of these activities depends, in turn, on the need as reflected in growth in demand, and on financial incentives. There is a crucial interdependence among these factors," the committee emphasizes.

**Natural gas and NGL . . .** In addition to its tabulation on crude oil discoveries by year, the committee provides similar tables which can be used for natural gas and for natural gas liquids.

It notes some factors involved in upward revisions of estimated recoveries of crude oil—such as secondary recovery and other improved recovery methods—are not applicable to natural gas.

Also, gas recovery is generally more efficient because of its natural expulsion force.

"Thus, the theoretical limit of gas-in-place would be reached sooner than in oil and would tend to restrict the magnitude of future upward revisions."

Even so, some upward revisions of recovery estimates for both natural gas and natural gas liquids have resulted from technological im-

## *"Old" Reserves Jump 50% in 15 Years*

TO SHOW how long-discovered fields keep adding to U. S. reserves, NPC compared its 1960 estimates with those made by the Petroleum Administration for War back in 1945.

Where PAW estimated 37.5 billion barrels of recoverable crude oil in all fields found prior to 1944, NPC now estimates 56.2 billion barrels.

Included in the increase was nearly 3 billion barrels credited to fields discovered 25 years or more before the PAW study. Here's how the two estimates compare:

(Millions of barrels)

| Fields discovered during period— | PAW estimate 1945 | NPC estimate 1960 | % Change 1945-60 |
|---|---|---|---|
| Total through 1919 | 14,640 | 17,367 | 19 |
| 1920-24 | 5,290 | 8,927 | 69 |
| 1925-29 | 7,211 | 9,967 | 38 |
| 1930-34 | 10,608 | 13,364 | 26 |
| 1935-39 | 9,130 | 14,534 | 59 |
| 1940-44 | 5,243 | 9,452 | 80 |
| 1920-44 | 37,482 | 56,244 | 50 |

## Capacity by PAD Districts and . . .

| | Crude (Th. bbl. daily) | Gas liquids (Th. bbl. daily) | Gas (M.M.c.f. daily) |
|---|---|---|---|
| Dist. 1 | 29.0 | 10.2 | 990.3 |
| Dist. 2 | 1,555.0 | 162.6 | 8,203.6 |
| Dist. 3 | 7,331.0 | 1,501.8 | 58,121.2 |
| Dist. 4 | 664.0 | 37.0 | 2,327.0 |
| Dist. 5 | 1,006.0 | 88.0 | 1,862.0 |
| Total U. S. | 10,585.0 | 1,799.6 | 71,504.1 |

## How It Would Flag Without Drilling

| | Crude (Th. bbl. daily) | Gas liquids (Th. bbl. daily) | Gas (M.M.c.f. daily) |
|---|---|---|---|
| Jan. 1, 1960 | 10,585.0 | 1,799.6 | 71,504.1 |
| Jan. 1, 1961* | 9,694.0 | 1,719.6 | 67,788.9 |
| Jan. 1, 1962* | 8,905.0 | 1,647.4 | 64,324.9 |

*Projected on basis of no drilling.

provements, the committee reports.

**Productive capacity . . .** The NPC report also estimates the productive capacities for crude, natural gas, and natural gas liquids. The estimates for capacities on January 1, 1960, were:

Crude oil: 10,585,000 bbl. daily.

Natural gas liquids: 1,799,600 bbl. daily.

Natural gas: 71,504,000 M.c.f. daily.

These figures, like the discovery-year figures, should not be digested raw.

In each case, the committee emphasizes, the potential productive capacity is by no means a measure of current availability.

That 10,585,000 bbl. daily figure for crude, for example, does not mean that much crude could have been produced on January 1, 1960.

There would be limits on storage and transportation facilities, and there would often be governmental restrictions on production rates.

Furthermore, that 1-day potential could not be maintained without new drilling. According to the committee's estimates, it would decline in a year's time to 9,694,000 bbl. daily. (This figure is comparable to the IPAA's recent estimate of a 1960 capacity of 9,708,000 bbl. daily that could be maintained for 6 months to a year without new drilling.)

For natural gas, the productive capacity figure must also be viewed in proper perspective.

Since storage of gas is expensive, gas production obviously would be limited largely to available pipelines to move it to market.

Also, since some gas is produced with oil, the total productive capacity of gas would depend on a total production of oil.

However, in making the current report, the NPC committee bases its estimates on the volumes that could be recovered under maximum conditions.

It appears clear that in crude, natural gas and natural gas liquids, there is a big gap between potential capacity and availability.

For that reason, there would seem to be more need for emphasis—by Government and industry—on the factors affecting availability than concern over the potential supply of crude oil or natural gas.

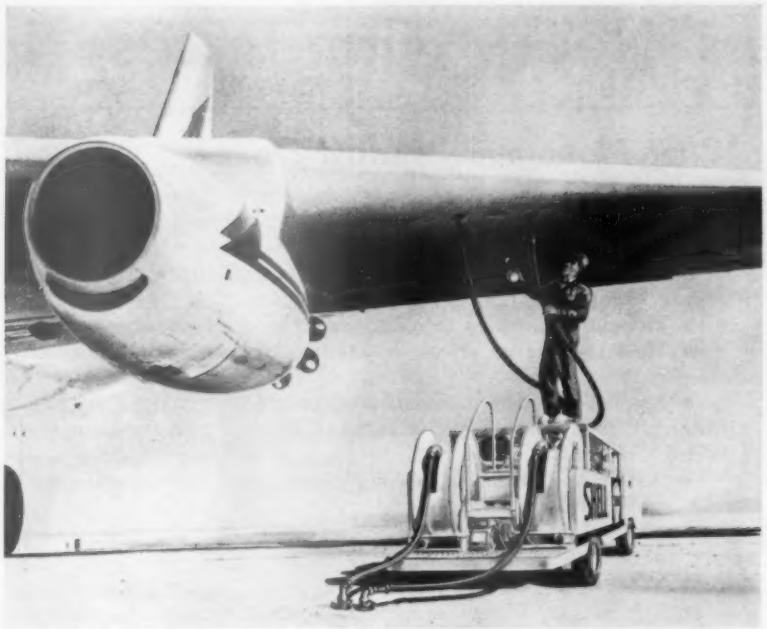
From the wording of the report, this seemed to be what the committee had in mind:

The oil and gas is there. The problem is to keep the climate right for finding, producing and distributing it.

# New Estimates of Discoveries Made in Past Years

| Fields and reservoirs discovered: | Crude oil (millions of bbl.) | Natural gas (billions of cu. ft.*) | Natural gas liquids (millions of bbl.) |
|---|---|---|---|
| Through 1919 | 17,367 | 75,777 | 1,230 |
| And in: | | | |
| 1920 | 2,415 | 2,063 | 83 |
| 1921 | 2,952 | 3,243 | 120 |
| 1922 | 1,437 | 34,646 | 417 |
| 1923 | 1,341 | 2,329 | 60 |
| 1924 | 782 | 1,702 | 39 |
| 1925 | 541 | 1,742 | 29 |
| 1926 | 2,925 | 5,021 | 101 |
| 1927 | 1,628 | 13,759 | 226 |
| 1928 | 2,465 | 5,349 | 170 |
| 1929 | 2,408 | 10,864 | 215 |
| 1930 | 6,653 | 7,386 | 740 |
| 1931 | 2,508 | 4,429 | 155 |
| 1932 | 531 | 3,749 | 69 |
| 1933 | 1,213 | 4,685 | 63 |
| 1934 | 2,458 | 10,386 | 326 |
| 1935 | 2,911 | 13,708 | 396 |
| 1936 | 3,502 | 17,320 | 295 |
| 1937 | 3,331 | 15,831 | 441 |
| 1938 | 3,526 | 18,349 | 447 |
| 1939 | 1,264 | 10,686 | 327 |
| 1940 | 2,838 | 10,980 | 395 |
| 1941 | 1,962 | 8,682 | 276 |
| 1942 | 1,336 | 6,933 | 261 |
| 1943 | 1,474 | 6,908 | 161 |
| 1944 | 1,841 | 6,812 | 235 |
| 1945 | 1,703 | 12,431 | 315 |
| 1946 | 1,401 | 7,520 | 237 |
| 1947 | 1,275 | 8,492 | 218 |
| 1948 | 2,592 | 8,169 | 481 |
| 1949 | 2,676 | 20,845 | 510 |
| 1950 | 2,224 | 8,153 | 237 |
| 1951 | 1,357 | 11,083 | 201 |
| 1952 | 1,408 | 15,012 | 338 |
| 1953 | 1,665 | 10,371 | 286 |
| 1954 | 1,515 | 13,638 | 309 |
| Total | 91,425 | 419,053 | 10,409 |

*At 14.65 psia. and 60° F.



**HOSE CART** links jet's fuel tanks to underground hydrant system—capable of pumping 2,400 gal. of fuel per minute—in Shell's planned facilities.

# Hydrants Speed Jet Fueling

UNDERGROUND-HYDRANT systems are the answer to airport fueling problems brought on by the explosive growth in jet traffic.

Jet aircraft gulping fuel at the rate of 2,400 gal. an hour need storage tanks almost four times the size of the 6,000-gal. tanks on piston planes. This means large volumes of fuel must be loaded in a short time to avoid expensive delays and congestion at airports.

Jet-fuel consumption in 1959 was more than double that of the previous year, and an increase of the same magnitude was recorded in 1960. Consumption will be up more than 40% this year, according to industry forecasts, to about 130,000 bbl. daily.

Shell Oil Co., leading supplier of jet fuel, is also taking the lead in installing underground-hydrant systems. Though more expensive, these systems are considered to have an edge over loading from trucks where large volumes are involved.

In the underground system, fuel is pumped directly from storage tanks through pipelines to plane-servicing areas, cutting down on truck traffic.

**New hydrant systems . . .** Shell is installing hydrant systems at San Francisco, Los Angeles, Atlanta, Anchorage, and Honolulu. The Los Angeles and San Francisco systems will be completed this summer.

Shell will own the systems, which will serve two or more airlines.

In other cases, individual airlines for which Shell is building the systems will finance and own the facilities.

Hydrant systems built and owned by others are operating at Washington, D. C., Fort Worth, Miami, Dallas, and St. Louis. New York International Airport and O'Hare Field in Chicago are to be supplied by the new type of fueling system within 2 years. Shell has been a design and construction adviser on four of these systems.

A major problem in designing a fueling system has been the severe surge pressure encountered when product flow is stopped suddenly. The pressure surges could seriously damage plane parts in the region of the fuel tanks.

Shell's solution was to integrate hydraulic control valves with the proper size of pipe. The hydrant carts used in conjunction with the underground system are equipped with surge controls.

**Hydrant-system advantages . . .** The underground hydrants amount to an extension of pipeline service from storage tanks to the plane itself.

In the case of Shell's installation at Los Angeles International Airport, fuel will move directly from the company's Wilmington-Dominguez refinery, 18 miles away, to the hydrant system.

Some of the major benefits of this fueling technique are:

**. . . Simultaneous fueling** of two or more jets at high loading rates (1,200 gal. a minute each). The hydrant systems usually can pump up to 2,400 gal. a minute for each supply line.

**. . . No more double handling** of fuel. Double handling is one of the big drawbacks in pumping from storage into trucks and then into planes.

**. . . Reduced ground traffic.** This is achieved by replacement of trucks with small hydrant carts which connect the hydrant-system pipes to aircraft fuel tanks. The carts are equipped with flow and pressure controls, filters, and connecting hoses.

## California Standard plans big refinery on Kenai Peninsula

ALASKA's first major refinery will be built by Standard Oil Co. of California, Western Operations, Inc.

A 20,000-bbl. plant on the Kenai Peninsula is slated.

The plant will charge crude from Swanson River field, which is making 14,000 bbl. daily. Standard of Cal, operator in the field, is running six rigs in a development drilling program.

Site of the plant has not been picked. A likely spot would be Nikiski on the Cook Inlet. This is the terminus of the crude line running from Swanson River.

Alaska has no refining capacity at present. A topping plant with a capacity of 2,000 to 2,500 bbl. daily is planned near Anchorage by Western Frontier Oil & Refining Co., a firm organized to build the plant. Completion is due in September.

Crude from Swanson River currently is being tankered to California or to Puget Sound refineries.

# Marketers' Need: Firm Prices, New

OIL MARKETERS are more price conscious than ever before.

The financial strength of the oil industry and its ability to expand in the future rest on how well company managers can live with oversupply and nearly static demand and yet receive a profitable price for products.

These are the dominant impressions that 1,248 delegates carried away from the Miami Beach sessions of the API Division of Marketing and allied organizations.

**Bitter talk . . .** John G. Winger, vice president and petroleum economist for Chase Manhattan Bank, New York, startled marketers with a gloomy picture of the economics in their business.

He said that natural gas and its liquids are threatening to dominate the energy markets, even transportation, long the stronghold of crude-oil products.

Here's the trend: Gas has pulled even with oil in the space-heating market, dominates the industrial energy market, and is making inroads in transportation through LPG fuels.

Since gas is a relatively low-priced fuel, it is playing hob with the economics of the oil industry, even though the production segment of the oil industry also produces the bulk of the gas.

Gas, he said, sells at an average price of 48 cents per M.c.f. for all industrial, residential, or other uses. This is equivalent to $2.70 a barrel for oil.

But the gas-transmission and utility companies get the lion's share of this income. Thus, while gas represents 40% of the oil industry's production, gas accounts for only 7% of its income.

Producers, then, must finance the great bulk of industry growth and expansion from oil income.

The ultimate result, Winger says, is that the industry must rely more heavily on revenues from gasoline. Eventually it will have to charge more for gasoline to stay alive, thus placing a greater burden on the motorist. That's something the planners in Washington didn't bargain for when they conceived price controls on natural gas, Winger said.

Winger pointed to another trend. With every increase in gas markets, more crude is displaced. This forces refiners to shift yields to get more gasoline from a barrel of crude. And, it forces the industry to cut back on crude production. Thus, the effects of gas competition are felt right back to the wellhead.

**Some action . . .** Winger told the marketers they had only two courses of action.

"You cannot afford price cutting," he declared, indicating this is the same as committing industry suicide under present conditions. He added that positive action should be taken to retain the space-heating market through better burner equipment, hard-sell, and promotion efforts with builders.

Winger said his bank sees central air conditioning in the years ahead as a tremendous growth market. The surface has barely been touched in many areas of the country, he said. As yet, the dominant fuel which will power these units has not been determined, and fuel oil has a chance to move into this coming battle.

Winger chided marketers for not doing more to glamorize use of the automobile.

He pointed out that just 10 more miles per day of driving per motorist would mean 5.6% more gasoline consumption and produce 3.2% more revenue.

But if the motorists, through economy, save one mile per gallon of gasoline used, it will lower consumption 6.5% and cost the industry 3.7% in revenue. This means the industry would have to charge 1.5 cents more per gallon of gasoline to maintain its revenue on the lower consumption base.

**Runs and prices . . .** Several speakers took the refiners to task for grinding out too much product for marketers to sell.

This came in for some attention at sessions of both the National Oil Jobbers Council and the jobbers advisory committee of API.

Area-pricing schemes, advanced by many oil companies, in an attempt to combat price wars also drew fire at several sessions. The jobber segment generally complained that the plans sought to increase company netbacks by lowering jobber margins. Executives of other companies also criticized area pricing as price cutting in disguise.

Two aspects of the area-pricing plans, however, apparently find favor: Discontinuance of guaranteed dealer margins and the feathering out of prices from a central point.

With margins no longer guaranteed, the feeling is that price wars will be discouraged because dealers and jobbers will suffer right along with the companies.

The feathering-out plan also tends to prevent cross-hauling of cheap products from a price war area into stable areas. This cross-hauling in the past has been the means of

## What Management Must Do

FEW SPEAKERS or executives talking off the record at the API's marketing meet in Miami Beach claimed to have the one big answer to the pricing problem.

But the consensus was that the ticklish economics of the oil industry now require management to:

- **Pay closer attention** to refinery runs to avoid oversupply.
- **Hold the line on prices,** emphasizing service to the customer and quality of products.
- **Expand the market** for all products. (This would be the real salvation of the industry and it came in for major emphasis at the meet.)
- **Assure fair treatment** by companies to their jobbers and dealers—and vice versa.

# Product Uses

spreading price wars from one place to another.

**Service vs. price . . .** Dwight Benton, vice president for sales of Indiana Standard, told the API jobbers advisory committee that the industry is putting a disastrous overemphasis on price and is under-emphasizing its customer services and product quality.

He declared the motorist really is not price conscious until the oil companies make them so by huge cut-price signs.

He said this price advertising distorts the industry image with the public, makes the motorist believe normal prices are out of line, irritates the jobber and dealer who try to avert price wars. The industry, he urged, must sell more than price.

**New markets . . .** There are heartening reports that the industry drive to expand oil markets has made much headway within the last year.

The fuel-oil segment of the industry got a stirring report from Glenn Werly, new president of the National Oil Fuel Institute, that a program of positive action has been mapped. The program centers on technical, educational, promotional, and advertising fronts to meet the competition of gas and electricity for the space-heating market.

Lubrication men heard that giant strides are being made to get the story of API recommended oil-drain practices across to the motoring public. The gasoline-oil ratio has quit dropping. Through the newspapers, magazines, radio, and TV the nation is learning that the 2,000-mile oil change actually means economy for the car owner.

The Travel Development committee also had good news that its program to expand travel is off the ground. Communications media are cooperating in the drive to encourage "See America Best by Car." State agencies are joining to promote tourism. These plans will be supported by an API-sponsored advertising campaign this summer and by individual companies promoting auto travel in their own advertising projects.

# watching WASHINGTON

Clyde La Motte

## • There's no end in sight for oil-import studies . . .

MORE SCRUTINY of the oil-import-control program is under way.

The Office of Civil and Defense Mobilization wants to determine whether there is any need, from a national-security standpoint, for controlling residual fuel imports (Page 112).

A congressional committee is going to take a look at the practice of quotas for inland refiners who don't use foreign oil.

And it's entirely likely that the imports program will become involved in the mid-June hearings by the Senate Interior Committee on a proposed fuels study.

All this comes on top of the recent crude-import hearings by Interior and the airing of residual fuel controls by that agency earlier in the year.

The whole business makes commuting to Washington a pretty regular thing for many men in the oil industry.

Naturally there is a lot of rehashing in some of these studies. So much so that when the representative of one oil group in Washington was asked whether he would appear at a particular hearing, he replied that his group might just send over a transcript of testimony it had presented at an earlier hearing by another agency.

There is little hope that such probes will ever end. For when any change is made, or even contemplated, some group in or out of the industry becomes unhappy and persuades a branch of the Government to reopen the subject.

## • A congressman takes a dim view of "quota swapping" . . .

REP. WRIGHT PATMAN (D.-Tex.), chairman of the House Small Business Committee, issued a call last week for a hearing on quotas for inland refiners.

Patman indicated he didn't think much of the practice. He said it seems to result in the "buying" of inland markets by major importers. And he figures this lessens, rather than increases, competition.

Patman won't conduct the probe himself. It will be handled by a small business sub-committee under Rep. Tom Steed (D.-Okla.).

## • IPAA provides a box score on industry testimony . . .

A BOX SCORE on views expressed at Interior's recent import hearing has been compiled by the Independent Petroleum Association of America.

IPAA lists the broad issues and gives a nose count on how many witnesses were for and how many were against a particular move.

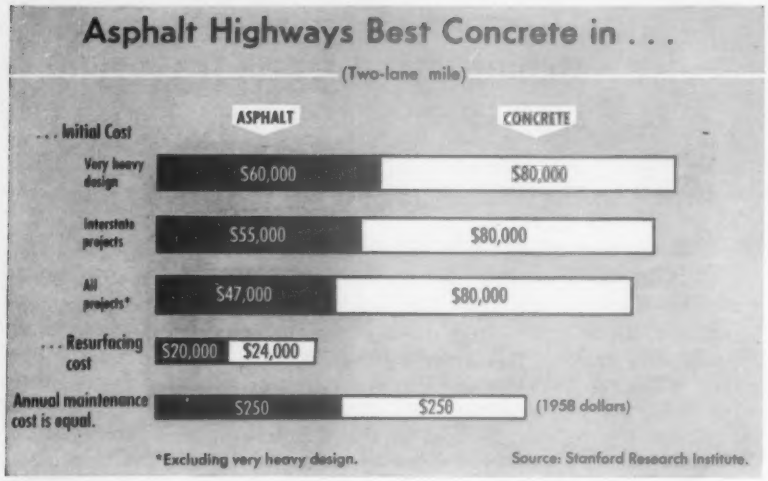
For instance, the tabulation shows 70 for and only one against continuation of crude-oil-import controls.

It shows that all 20 trade associations represented at the hearing favor a reduction in imports, while six of 55 companies were for a cut and eight were against one. (The remaining companies did not express a view.)

On Canadian overland imports, 11 companies favored unrestricted exemptions. Seventeen associations and 20 companies said the exemptions were all right as long as they were kept at "moderate" levels.

Seven companies and 17 associations wanted the exempt oil included in the over-all import level, while 4 companies opposed such a change.

But IPAA, or anyone else, doesn't know at this point how Interior itself will "vote." And that vote is the deciding one.




# Study Favors Asphalt Roads

IF PORTIONS of the Interstate Highway System which haven't been put under contract were built of asphalt instead of portland cement, the total first-cost savings would be about $1.1 billion.

That's the conclusion of Stanford Research Institute in a survey on paving.

About 40% of the portions of the interstate system constructed so far have been built of asphalt. The remainder of the completed roads have been built of portland cement.

The study, prepared for the American Petroleum Institute, points out that if this ratio holds for the rest of the system, potential first-cost savings would be about $440 million during a 10-year construction period.

Not only would initial cost be lower, the report says, but asphalt would also have a lower over-all annual cost over a 40-year period.

Asphalt is usually attacked for its high maintenance costs, but the Stanford report goes counter to this. Maintenance costs, it shows, are about equal for both types of paving.

These conclusions are based on cost data from 13 toll roads and 2,500 highway projects in 21 states. Major elements in the comparison were initial cost, resurfacing cost, annual maintenance cost, time until first resurfacing, and interest on capital.

Since the report is an objective production by a respected research institute, it should be a potent new weapon for asphalt salesmen.

**Cost comparisons . . .** The total average annual cost per two-lane mile for all projects studied was $5,371 for portland-cement concrete, compared with $3,760 for asphalt concrete. Figures are based on an interest rate of 5%.

The indicated saving through use of asphalt would be $64,440 per two-lane mile, or $1,611 per year, in 40 years.

On portland-cement roads, the study showed, initial cost for all projects averaged $79,700 per two-lane mile. Resurfacing cost was $24,200 per mile.

Comparable asphalt costs were $47,200 and $19,800.

Maintenance costs on both pavements were figured to be about $250 per year for a 40-year period.

**Interstate system costs . . .** The interstate system, with heavy-duty construction, was considered separately. For these highways, the study found the initial cost of portland cement to be $79,500 per two-lane mile compared to $55,300 for asphalt.

At 5% interest, the average cost per mile per year for portland cement was fixed at $5,353 compared with $4,232 for asphalt. Thus $44,840 per two-lane mile would be saved on interest payments over 40 years by using asphalt.

If a "very heavy design" were used on the interstate system, portland cement would average $79,800 per two-lane mile compared to $59,800 for asphalt. This would result in a saving of $925 per year per mile, or $37,000 total, with asphalt.

The Stanford study concluded that a 21% saving would result from using a very-heavy-design asphalt pavement instead of a similar design keyed to the use of portland cement.

## Switch to Tenneco brand under way at TGT's outlets

TENNESSEE Gas Transmission Co. has taken a big first step toward converting its service-station outlets to the new Tenneco brand name and expects to have the job completed in more than 1,000 stations within a year.

Through its subsidiary, Tenneco Oil Co., TGT has changed the Bay brand name to Tenneco at 300 stations in 15 of the 22 states in the company's marketing area.

Approximately 85% of Tenneco's 800-plus stations have displayed the Bay sign in the past. All of these stations will be showing the Tenneco brand by the spring of 1962.

More than 100 other company

## INDUSTRY

**Mobil Chemical is offering** $20 million for O. & M. Kleeman, Ltd., a British plastics processing and marketing firm. Officers and directors who hold 42% of the plastics firm have approved the sale at $2.73 a common share and $3.15 for preferred. Mobil's offer hinges on buying at least 90% of the outstanding stock.

**A gas contract** covering new reserves off Santa Barbara County, California, has been signed by a third company. Phillips Petroleum and most of its partners in two tracts will sell gas to Pacific Lighting Gas Supply, parent of two Los Angeles utilities. Texaco and Standard Oil Co. of California already are selling gas to PLGS.

outlets which use such brand names as Speed, Crown, Citizens, and Par will also switch to Tenneco.

To all these, Tenneco expects to add more than 150 new outlets within a year. This will push the grand total past 1,000.

The company says it is marketing new "top-quality gasolines and lubricants" which it labels the "Quality Twins."

Tenneco has produced a new additive for both premium and regular, and has reformulated the base stocks and additives for its lubricants.

The new Tenneco emblem is shaped like a shield and bears the word Tenneco in the center. Colors are red, white, and blue.

Stations using the new emblem are in Colorado, Kansas, New Mexico, Nebraska, Wyoming, Alabama, Louisiana, Mississippi, Texas, Florida, Georgia, Kentucky, North Carolina, South Carolina, and Tennessee.

All stations using the Tenneco brand name will market gasoline at major-station prices.

Bay-brand stations in the southeast which have marketed at 1 or 2 cents below major prices will move to the higher rate as they convert to Tenneco. Bay stations in the Rocky Mountains which have marketed at major prices will continue to do so under Tenneco.

## More West Central Texas Gas to Go East

A BIGGER outlet for West Central Texas gas will be provided by a $2-million trunk line running from Gordon in Palo Pinto County to a hookup with the Lone Star Gas Co. system at Springtown in Parker County.

Lone Star crewmen are shown at work on the 52-mile, 18-in. line.

Initial capacity will be more than 100,000 M.c.f. daily. Completion is expected by the end of May.

The line will move gas from a growing number of new fields—particularly in Erath, Palo Pinto, and Stephens counties.

On the west the line will tie in at Lone Star's Gordon gasoline plant with a 12-in. line gathering gas from Brown, Comanche, and Eastland counties. At Springtown, on the east, the line will hook up with a 20 and 24-in. main extending into Dallas County.

## BRIEFS . . .

**New Jersey motorists** were quickly saddled last week with a 6-cent gasoline tax, a 1-cent increase. A proposal for a half-cent increase had been pending before the legislature. But Governor Meyner's administration suddenly threw its weight behind the full cent hike which was reported out of committee and enacted into law in a single day.

**British American's new marine terminal** at Port Hawkesbury, Nova Scotia, has received its first shipment of products, 130,000 bbl. of bunker fuel from Venezuela. The Tanker "BA Canada" docked at temporary moorings since the terminal's 850-ft. dock is still under construction. The dock, warehouse facilities, and other product tankage will be completed later this year.

**Northern Illinois Gas** has asked the Illinois Commerce Commission for power to bring condemnation suits to acquire underground storage rights on 10 parcels of land for its Crescent City storage reservoir. The utility has acquired storage rights on all except 650 acres of the 5,300-acre area.

**Twelve producing oil wells in** Pewitt Ranch field of Titus County, Texas, have been acquired by American Petrofina from Paul H. Pewitt. The wells produce from Paluxy formation at about 4,500 ft. and are adjacent to other Petrofina properties.

**White Eagle International** has acquired the Holgate Co. and its wholly owned subsidiaries, Holgate Brothers and Nosco Plastics of Erie, Pa. The operating company, Nosco Plastics, is one of the top 10 custom injection moulding companies in the nation.

**Bill aimed at curtailing** direct gas sales by producers has been shelved by California Senate. Since proposal has been referred to Senate Rules Committee for interim study, it is not likely to come up again until 1962. Under the bill, direct sales to a customer in a utility's franchise area would be prohibited.

**Seismic crews** of Shell Oil and Tennessee Gas Transmission are at work on the Atlantic seaboard. Both sets of crews have been shooting off Delaware, and their range is reported to extend along a much greater part of the coast.

# Conch to Ship Liquid Methane from Algeria to Britain

SAHARA Desert gas will be liquefied and moved to Great Britain in refrigerated tankers under terms of a deal announced by L. F. McCollum, president of Continental Oil Co.

Principals in the deal are Conch International Methane, Ltd., the Gas Council of Great Britain, and a group of French producing companies.

Conch is owned by Continental, the Royal Dutch-Shell Group, and Union Stockyard & Transit Co., Chicago.

McCollum said terms and conditions of the agreements will be submitted to appropriate United Kingdom government authorities. Details of the agreement were not revealed.

McCollum reported the gas will be liquefied in a special plant to be constructed at Arzew, near Oran in North Africa. The plant will be built by a company formed by Conch and the French producers—BRP, Air Liquide, and Les Societies de Development Regional de l'Algerrie et du Sahara.

The liquefied gas will be moved to the United Kingdom in specially built refrigerated tankers. In Britain, the liquid will be regassified and blended into regular distribution systems with gas manufactured from coal.

The gas agreement is the climax to several years of experimentation into refrigerated tanker movement of LPG by Conch and predecessor groups. The technical and economic feasibility of such movement was proven conclusively in seven trial voyages of the "Methane Pioneer" from Lake Charles, La., to the Thames River near London in 1959 (OGJ, Oct. 26, 1959, p. 52).

# Commercial Scouting Spreads in Texas

RINEHART Oil News Co. has won a three-way battle to operate a commercial scouting service in South and East Texas. The company also hopes to extend the operation into South Louisiana.

The development in Texas means that four different organizations have staked out separate domains for furnishing scout information.

Producing companies are served on a contract basis.

The newest location is considered to be the choicest of the four because it includes Houston, home base of many producers.

Previously contract scouting developed in the Rocky Mountains under Well Record Service, Denver; in the Mid-Continent under Data, Inc., Tulsa; and in West Texas and eastern New Mexico under Williams & Lee Scouting Service, Inc. (OGJ, July 4, 1960, p. 63).

Competing with Rinehart for South and East Texas were Data and Well Record Service.

**Rinehart lineup . . .** Last week Rinehart had eight companies committed to start the Texas service on July 31.

Several major companies plan to continue their own scout check, and it is uncertain whether they will subscribe to the Rinehart operation.

Rinehart did not disclose the names of the companies it signed up, but industry sources identified them as Sohio, Mobil, Conoco, Ohio, Texaco, Pan American, Gulf, and Tidewater.

**What clients get . . .** Rinehart will provide the contract clients in Texas the following information:

Daily first-report tickets, daily completion tickets summarizing final data in chronological order, daily field bulletins on important tests. Also, Rinehart will provide a weekly cumulative drilling report by area, a weekly report of commencements, a plugged-producer report, a geophysical-activity report from data supplied by members, and a weekly completion work sheet adaptable to map-room operations.

Wildcats will be checked regularly and member-company drilling reports will be picked up daily.

The 36-year-old Rinehart organization currently publishes 27 daily, semiweekly, and weekly oil reports.

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# Trans-Canada Nears Breakthrough on Profits

• Big pipeline company may pull out of red this year for first time since it got going. Sights are fixed on lowest operating cost in North America.

THE FIRST profitable year for Trans-Canada Pipe Lines, Ltd., may be recorded in 1961, third year of operation for the Alberta-Montreal gas line which was built at a cost of $416 million.

Trans-Canada turned in its first profitable quarter last October-December.

This achievement left the company with a loss of $2,911,148 for 1960. The loss tallied in 1959 was $8,410,511.

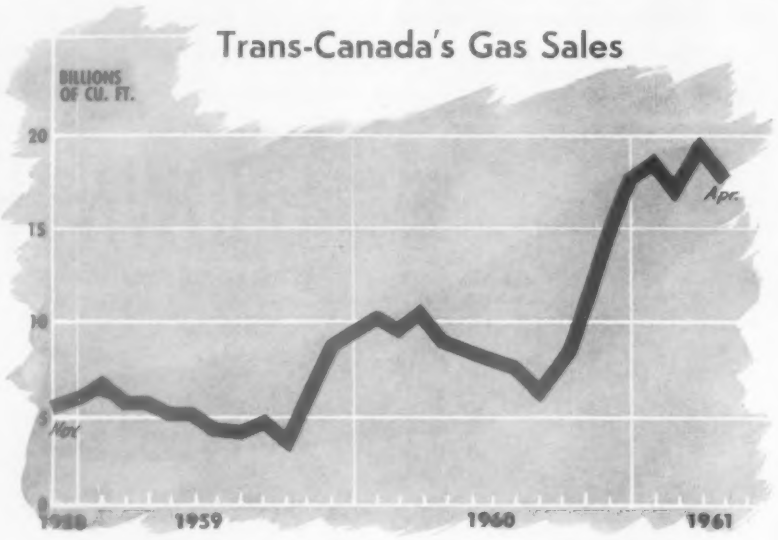
Judging from the company's performance so far, the deficit will be slashed dramatically again this year—even if Trans-Canada doesn't finish up in the black.

Three factors make Trans-Canada confident about its near and long-range prospects. They are:

**. . . Rapidly rising gas sales,** illustrated by the chart.

**. . . Unusually low operating costs** because of automation.

**. . . A huge low-cost supply** of gas which is expected to be stable or to decline in price in the next few years.




**Gas sales spurt . . .** In its second full year of operation, Trans-Canada sold 128 billion cubic feet of gas—71% more than in 1959.

The fourth-quarter volume last year was 79% above the comparable 1959 period, and the first quarter of 1961 exceeded the first quarter of 1960 by the same percentage. April of this year was even better—up 91%, largely because of big, new, interruptible industrial loads.

A daily peak of 715 million cubic feet was reached in March 1961, almost double the daily peak of 289 million cubic feet in March of last year.

A major factor in the growth has been the export into the U. S. Great Lakes area of up to 204 million cubic feet daily. This operation began last fall. Midwestern Gas Transmission Co., a subsidiary of Tennessee Gas Transmission Co., is the importer.

Trans-Canada will start deliveries into upstate New York, through Niagara Gas Transmission, Ltd., within a year if a Federal Power Commission examiner's ruling stands as expected.

Company officials also hope that "before too many more weeks slip by," FPC will approve the sale of 204 million cubic feet daily of interruptible supply to TGT at Niagara Falls.

There is further encouragement in the prospects for increased business in the Quebec market.

**Automated gas turbines . . .** Trans-Canada is cutting operating costs sharply by going to gas-turbine drive for centrifugal compressors. Gas turbine units have a lower over-all cost than reciprocating-engine units, company officials believe.

Some 51,000 hp. will be installed on the 2,340-mile 34-in. to 20-in. system this year, boosting the system horsepower total to almost 200,000 hp. Half of the total will be in gas-turbine units which are being automated.

By the end of summer, the Trans-Canada dispatcher will have push-button control from Toronto over 11 gas turbines which are as much as 1,500 miles away in Saskatchewan and Manitoba.

"It would appear we are headed toward the lowest pipeline-operating costs per mile in North America," James W. Kerr, president and chairman of Trans-Canada, recently told the New York Society of Security Analysts.

**Gas-price plateau? . . .** Kerr is confident of being able to sell increasing

## PIPELINE

**The backlog** of pipeline-construction applications awaiting FPC action swelled slightly in April. At month's end there were 199 projects involving $864,677,557 before the commission. They covered 7,093 miles of pipelines and 664,980 hp. in compressor stations. FPC disposed of 12 applications in April, and 14 new ones were filed.

**Authorization** for St. Lawrence Gas, Ogdensburg, N. Y., to import gas from Canada has been reaffirmed by an FPC examiner. Initial approval was granted 13 months ago. St. Lawrence is a subsidiary of Consumers Gas, a Canadian company which distributes gas in Ontario. The examiner also rejected a proposal by New York State Natural Gas, Pittsburgh, to sell U. S.

volumes of gas for still another reason.

A shift toward a buyer's market is developing in Alberta. The forecast for new gas reserves of 2.5 trillion cubic feet in western Canada for 1960 was low, and the figure turned out to be 5 trillion. Four trillion was in Alberta.

Trans-Canada's average wellhead cost of gas last year was just under 12 cents per M.c.f. Until recently, the going rate for new gas started at 13.5 cents. The latest purchase was at a slightly lower price.

"I, of course, cannot accurately predict the future Alberta field-purchase price of gas," Kerr says, "but two facts indicate there could be a leveling off of the wellhead price or perhaps even a slightly downward trend."

First, there are only two large gas buyers in Alberta — Trans-Canada, and Alberta & Southern Gas Co. for the Alberta-California pipeline. The latter company, which has options on 9 trillion cubic feet of gas at 13.5 cents, isn't about to offer a higher price.

The second reason is the size of the gas surplus.

# Marketing Drive Launched

## . . . on national scale by new American Oil Co. Among goals: Expansion in Southwest, more super-stations.

A NATIONAL marketing campaign supported by a massive $100-million capital program was kicked off last week by the new American Oil Co., a subsidiary of Standard Oil Co. (Ind.)

The new company combines the regional operations of Standard of Indiana in the Midwest, American Oil Co. in the East and South, and Utah Oil Refining Co. in the Northwest (OGJ, May 22, p. 57). It now markets through 29,000 service stations in the 48 states of the continental U. S.

American's national push will have at least two important aspects:

**. . . Expansion particularly** in areas where American representation is thin or nonexistent—such as California, Arizona, and New Mexico.

"Seven states in the western and southwestern sections of the nation are expected to contribute almost 40% of the nation's total forecast population growth by 1980," L. W. Moore, American president, says. "We mean to be in there with first-class American Oil stations long before 1980."

**. . . More super-stations** of the type that went over big in Vincennes, Ind.; Mattoon, Ill.; and Fairfield, Iowa.

**Super-station plan . . .** P. H. Miller, American's vice president for marketing, has disclosed plans to launch in a larger market the same type of super-station program that has been tried in the smaller cities.

"This has been very successful," Miller says. "We are about to go into a city of over 100,000."

In Vincennes, Standard of Indiana formerly had nine stations that together sold just over a million gallons of gasoline a year. The company closed all but one centrally located station to serve the city of 20,000, and expanded it into a modern super-station.

Results surpassed expectations.

"Our gasoline volume in the one station has, in roughly a year, been brought to within one and a fraction per cent of the combined gallonage of all nine previous accounts," Miller says. "Our total volume on TBA has been sharply increased, thanks to an intelligent job of merchandising by trained men on the driveway."

# BRIEFS . . .

gas to Niagara Mohawk Power in the same area St. Lawrence will serve.

**Authorization to build** 286 miles of 30 and 36-in. loops in six states has been given Transcontinental Gas Pipe Line by FPC. The $54.6-million project covers work in Texas, Louisiana, Mississippi, Alabama, Georgia, and South Carolina. Facilities will add 114,753 M.c.f. of gas daily to Transco's capacity.

**Testing** of prospective underground-storage facilities at a cost of up to $6 million has been approved for Texas Gas Transmission by FPC. Company can spend up to $2 million annually for 3-year period, but no single project can exceed $1,250,000 in value or 2 billion cubic feet in volume. Only off-peak gas can be used.

**Construction of 217 miles** of 30-in. line from St. Mary Parish in South Louisiana to Ouachita Parish in the northern part of the state has been temporarily approved by FPC for United Gas Pipe Line. The new line will cost $31.8 million and will add 358,000 M.c.f. of gas daily to United's capacity.

**Operating revenues** of interstate natural-gas-pipeline companies totaled $342,010,207 in February, latest figures show. This was an increase of 5.3% over February 1960. But volume was down. Sales to other gas utilities for resale totaled 784.6 billion cubic feet, down 2% from February of last year, and sales to ultimate consumers totaled 122 billion cubic feet, down 5.1%.

**Three gas-pipeline** companies have received approval for construction projects. FPC approved proposals of $1.5 million each for Kansas-Nebraska Natural Gas, Hastings, Neb., and Coastal Transmission, Houston. Michigan Wisconsin Pipe Line, Detroit, got approval for a $3-million project.

**Ten pump stations** and four delivery points along Continental Oil's Glacier Pipe Line system (OGJ, Oct. 24, 1960, p. 60) will be operated by a supervisory control system to be installed by Dresser Electronics. The system will cost $250,000 and will be completed in August.

**Texas Gas** Transmission has bought controlling interest in Kentucky Electronics, a small manufacturer of electronics components in Owensboro.

# OCDM Will Take New Look at Imports

**• Pressure from consumer groups, fuel-oil jobbers, and resid importers has undoubtedly played role in agency's decision to kick off a study. Only one point is involved: Are resid-import controls vital to national security?**

A STUDY of the residual-fuel-oil import-control program will be made by the Office of Civil and Defense Mobilization.

The sole issue will be whether controls are needed as a national security measure. Thus it will differ from the hearing by Interior earlier this year on how resid quotas should be distributed.

Interested parties have until June 22 to submit written views to OCDM. These will be made public and a 30-day period provided for rebuttals. No public hearing for oral testimony is planned.

Announcement last week that the study would be made was no surprise. The Journal had revealed weeks ago that such a move was likely (OGJ, Apr. 17, p. 85).

Pressure had been building up steadily, particularly from New England, for action by OCDM.

Support came from the New England Council—an industrial group—and other East Coast residual-fuel users who feel that controls have caused them to pay more for their fuel.

Other consumers and East Coast fuel-oil jobbers also complained about the program, along with resid importers.

These groups enlisted the backing of the New England congressional delegation, which first called on Interior and then turned to OCDM after Interior officials pointed out it was OCDM's duty to determine the national security aspect of the problem.

Chief argument of these groups: Import controls on resid do not strengthen the domestic industry but simply create shortages and higher prices.

And they contend that resid controls were tacked onto the initial crude-oil import program with little or no study to determine the extent of a national security need.

Support for continuation of resid controls will come largely from the coal industry.

Coal industry officials insist that a flood of cheap residual fuel oil from abroad would destroy coal markets in New England and would be a crippling blow to their industry.

They claim, too, that unlimited residual-fuel imports would affect the demand for domestic crude, thereby having an adverse impact on domestic oil producers.

The coal industry may get support from some domestic crude-producer groups.

At the Interior hearing, the Independent Petroleum Association of America testified there was danger that importation of too much resid might tend to weaken domestic crude demand and prices.

For the most part, however, the battle will be between coal and the New England industrial consumers.

# Seven Pools Add Luster to Louisiana Field

THE 8-YEAR-OLD Hollywood field near Houma, La., already a major gas-condensate field, has been made even bigger by the discovery of important new reserves.

Tidewater Oil Co. reported that the Southdown 12 logged 517 net feet of producing formation from 13 sands, seven of which are probable new reservoirs and three of which are deeper than any discovered earlier.

On a 6-hour production test of the deepest sand at 16,462-72 ft., the well flowed 3,200,000 cu. ft. of gas and 117 bbl. of 48°-gravity condensate daily through a 9/64-in. choke.

Flowing tubing pressure was 9,710 psi., and the pressure increased to 11,920 psi. after the well was shut-in 30 minutes.

Gas-oil ratio was 28,340 to 1.

The seven probable new reservoirs added 264 net feet to the producing formation. The other six sands—253 net feet—already had proved productive.

The Southdown 12 was drilled to a total depth of 16,588 ft. While other wells had gone that deep in the field, none had found oil beneath the 14,200-ft. Southdown sand.

The newest well is located near the center of the field, about 2 miles from the Houma city limits.

Because of excessive pressures the well will be completed singly at the deepest sand, the only one tested to date.

During drilling, the operators lost the drill pipe at about 14,000 ft. and had to whipstock. The well was completed with a 4-in. casing.

Tidewater says it has no immediate plans to develop the new reservoirs.

The company discovered the field in 1953 and has approximately 4,800 acres under lease in the area.

Tidewater built a 75,000,000-cu.-ft. natural-gasoline plant in the field early last year.

Hollywood field has been a bonanza to the 11,500 citizens of Houma because some of the original productive sands are within the city limits.

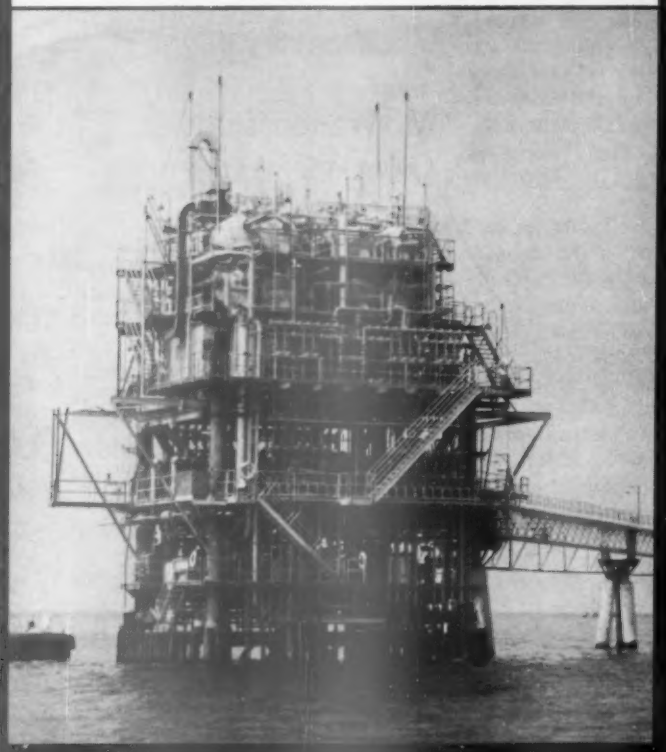
Under an agreement with Tidewater, Houma buys natural gas for about one-half the usual rate in South Louisiana and uses it to generate electricity at low cost.

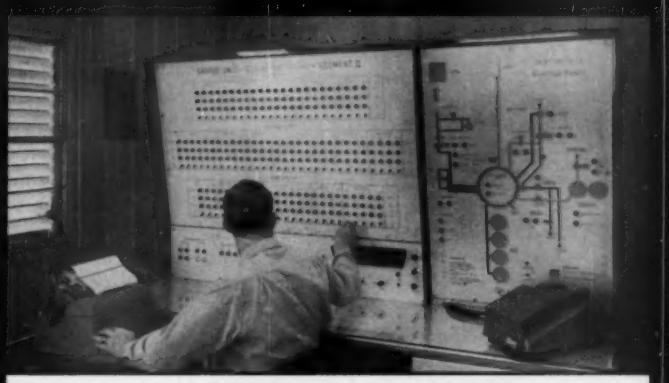
The city also received $80,000 last year in royalty payments, and 1,950 individual property owners received another $50,000.

# TI PROCESS CONTROL SYSTEMS

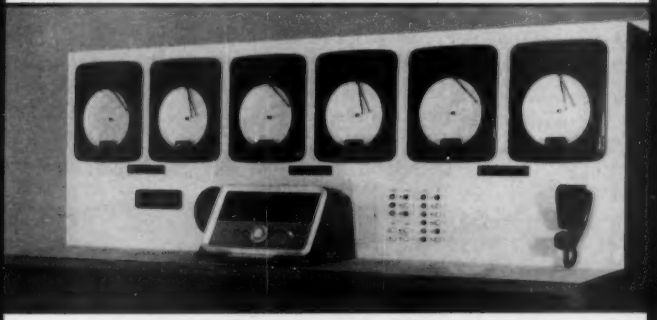
## *Automate Petroleum Production!*

Unattended crude gathering station in Venezuela's Lake Maracaibo automatically controls production of 48 completions.





SACROC supervisory control system in West Texas automatically tests wells, records all data over entire 76-well project.



On-shore console supervises and controls automated offshore producing platform near Corpus Christi, Texas.

Electronic equipment designed, built and installed by Texas Instruments controls the *unattended* production of crude in locations throughout the world. In the Lake Maracaibo installation, for instance, TI's process control system monitors flow and pressure from each completion; monitors and controls all functions of flow station operation, including automatic start-up, shut-down and well testing; and throughout the entire 100,000 BPD operation logs complete records of production and testing into punched paper tape.

In case of a malfunction — for example, a pump or engine failure — the system analyzes the situation, takes corrective measures, and sends classified alarm information to the remote monitoring station by radio. A maintenance engineer can then go to the seat of the trouble without repeating corrective measures already taken automatically. TI has recently contracted to provide the electronic equipment on two similar flow stations in Lake Maracaibo.

For West Texas' SACROC field, *the country's largest unitized oil producing operation,* TI designed a supervisory control and data gathering system that provides automatic and manual control for testing any of 76 wells, returning it to production or shutting it in. Wells on test are subjected to gas, oil and water separation with resulting data printed out in the central console.

Texas Instruments experience and abilities in petroleum automation systems are being applied in many fields of industrial process control and automation. TI's capacity for design and application of precise instrumentation assures efficient handling of the most complex projects.

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# Government Steps on Gulf, Union Oil Deal

• Union claims Gulf won't convert $120 million worth of debentures into common stock because of threat that Justice would take antitrust action.

THE DEAL which would give Gulf Oil Corp. control of Union Oil Co. of California apparently has been killed by the Justice Department.

A spokesman for Union told the Journal last week Union is buying $120 million worth of debentures from Gulf because the Government threatened antitrust action if Gulf tried to convert the debentures into common stock.

Gulf acquired the 3¼% debentures in 1956. They are convertible into 2,700,877 shares of Union common stock. This is approximately 30% of the stock outstanding.

If Justice has stopped the Gulf conversion possibilities, this will take Union from under the shadow of one of two majors keeping an eye on the West Coast company.

Phillips Petroleum Co. also has designs on Union. Phillips bought 15% of Union's stock between April 1959 and November 1960, but the Justice Department also stepped in here.

Now Phillips is under a temporary injunction which restrains the company from buying any more Union stock and from voting the 1,263,200 shares it holds.

Phillips claims it bought the Union stock as an investment. Phillips previously revealed that it paid an average of $43 a share for the Union stock (OGJ, March 6, p. 88). Last week the stock was selling for over $61 a share.

Union's management maintains Phillips bought the stock "secretly" in a move to grab control of the company.

An antitrust suit against Phillips is pending in federal district court in Los Angeles. Union's top executives have given affidavits supporting the Government's case against Phillips (OGJ, Dec. 26, 1960, p. 85).

The report from Union that the Gulf deal had been sidetracked came after Union announced the filing of a statement with the Securities and Exchange Commission. This statement covered the proposed sale of $120 million worth of debentures. Union will use the new revenue to buy the Gulf debentures.

The conversion price on the debentures went up just last month, which indicates Gulf either has no interest in converting at this time or has been told by the Government the conversion would run into antitrust problems. The conversion rate increased April 1 to $66.65 a share from $62.21.

Gulf also may be losing its interest in Union. When the debentures were acquired in 1956, Gulf had no marketing and refining subsidiary on the West Coast. Last year the company took over Wilshire Oil Co., one of the coast's leading independent marketers.

A Phillips-Union merger would create a giant company which would rank No. 3 in the nation in refining capacity, No. 6 in retail outlets, and No. 7 in crude production, reserves, and total assets.

## Water flood started in heavy-gravity California field

A WATER FLOOD started in Placerita field near Newhall, Calif., is expected to double the recovery from the low-gravity crude producer.

Sunset International Petroleum Corp. is flooding 400 acres in the field. Daily production from the 50 wells is about 850 bbl., just half the output expected when the flood reaches full force.

An additional 8 million barrels of oil is expected to be recovered. Primary recovery is between 7 and 8 million barrels.

Sunset has a five-spot pattern developed on 5-acre spacing. No new wells will have to be drilled, since the density in the field will permit some of the present producing wells to be converted to injection wells.

Placerita is a typical low-gravity California field.

Gravity of the oil ranges from 10° to 18°. The Lower Kraft zone, which will be flooded, is highly faulted and is about 200 ft. thick. The top of the zone ranges from 750 ft. to 2,200 ft.

There are several other operators in the field, but the flood will be limited to Sunset's holdings.

## Motivation study says auto travel can be encouraged

AMERICANS, contrary to popular belief, still enjoy driving and they can be motivated into using their cars more.

That's the conclusion of a motivation study conducted by Ethyl Corp. on the customs and mores of the motoring public. Ethyl Vice President Malcolm P. Murdock reported the findings before the mid-year meeting of the API Division of Marketing at Miami Beach.

"In spite of all the publicity by railroads, airlines, and bus companies, 86% of all the people interviewed said that they do not find other forms of transportation as pleasant or relaxing as the family

## PROCESSING

**Facilities** to recover ethane and increase propane production will be constructed by Goliad Corp. at its Wilcox gas-processing plant in Lavaca County near Sheridan, Tex. Overall capacity will increase only from 250,000 M.c.f.d. to 255,000 M.c.f.d. O. L. Olsen Co. has the contract for the $1,000,000 project. Completion is expected in October.

**Construction** of Tidewater's $20 million isocracking unit at Avon, Calif., will be handled by Bechtel Corp. Work will start immediately. Completion is set for mid-1962.

**Benzene capacity** of 6 million gallons annually is now on stream at British American's Montreal East refinery. The $2.5 million aromatics

automobile," Murdock announced.

The survey discovered that fear of accidents on the road is not a real deterrent to use of the family auto, and congested traffic conditions are only a minor deterrent.

People also said they do not limit the miles they put on the car in order to reduce the cost of gasoline and operation of the car.

Other interesting findings:

Women like to drive alone, except on long trips.

Both men and women get psychological benefits and enjoyment from driving a car.

A motorist doesn't really hate every other fellow on the road.

Most people enjoy driving in the spring and summer more than at any other time.

Most motorists enjoy trips where they have no particular destination in mind. And local sightseeing by car holds high preference.

Two vacation plans are becoming popular: The sleep-at-home vacation in which motor trips are taken during the day, and camping trips.

The Ethyl study gave encouragement to efforts on the API Travel Development Committee because it shows that motorists can be motivated to use their cars more and this is a workable way to expand sale of more petroleum products.

The committee will launch a test advertising campaign in June.

## Jersey Free of "Conflicting Interests"

JERSEY STANDARD stockholders were told last week they need not worry about any conflict-of-interest scandals in their company.

"We have insisted that our directors, officers, and employes avoid any conflict between their personal interest and the interest of the company," M. J. Rathbone, president of the company, told stockholders at the annual meeting in Boston last week.

"Every director, officer, senior officer, senior executive, and other key employe is required to sign a statement each year that he is familiar with his company's policy . . . and that neither he, nor any dependent member of his family, has interests which would violate this policy," Rathbone said.

"We are equally insistent that all employes shall obey the antitrust laws."

## FPC Maps Changes in Contract Rules

THE Federal Power Commission plans to outlaw certain types of daily - contract quantity provisions and take-or-pay clauses frequently found in contracts between producers and pipeline companies.

FPC would also set certain standards for "pipeline quality" gas involved in certificate and rate proceedings.

Under one rule, FPC would refuse to accept contracts which provide for a daily-contract quantity of more than 1,000 cu. ft. for each 8 million cubic feet of dedicated original reserves.

And it would turn down contracts with take-or-pay provisions which exceed 80% of such daily-contract quantity on an annual basis.

Under another rule, proposed standards would list minimum criteria for quality, pressure, and delivery conditions in determining whether the gas is of "pipeline quality."

If these minimums were not met, adjustments would be made in producer rates.

FPC said its purpose is to provide a common basis for evaluating independent producer rates.

# BRIEFS . . .

extraction plant was designed with provision for future production of toluene and xylenes. Benzene will be used in B-A's cumene operation.

**A maleic anhydride plant** has been put on stream by Reichold Chemical at Elizabeth, N. J. The $4 million plant, engineered and constructed by Badger Manufacturing Co., has a design capacity of 20 million pounds per year. The new plant is based on RCI's own process using the air oxidation of benzene in a fixed bed catalytic reactor.

**A new UOP Platforming unit** has begun operations at Regent Refining (Canada) Ltd.'s Port Credit, Ont., refinery. Capacity of the unit is 5,400 bpsd. of heavy straight run gasoline plus visbreaker naphtha. Feed is pretreated by a Unifining unit which was converted from an old catalytic reformer.

**A natural gas-processing plant** will be built at St. Landry, La. by South Louisiana Production Co., Inc., a subsidiary of Central Louisiana Electric Co. and Tidewater Oil Co. Production from 40,000 M.c.f.d. of gas will consist of 484 bbl. of propane, 278 bbl. of butane and 107 bbl. of natural gasoline. Construction of the $1 million plant is to get underway in July and completion is expected in December.

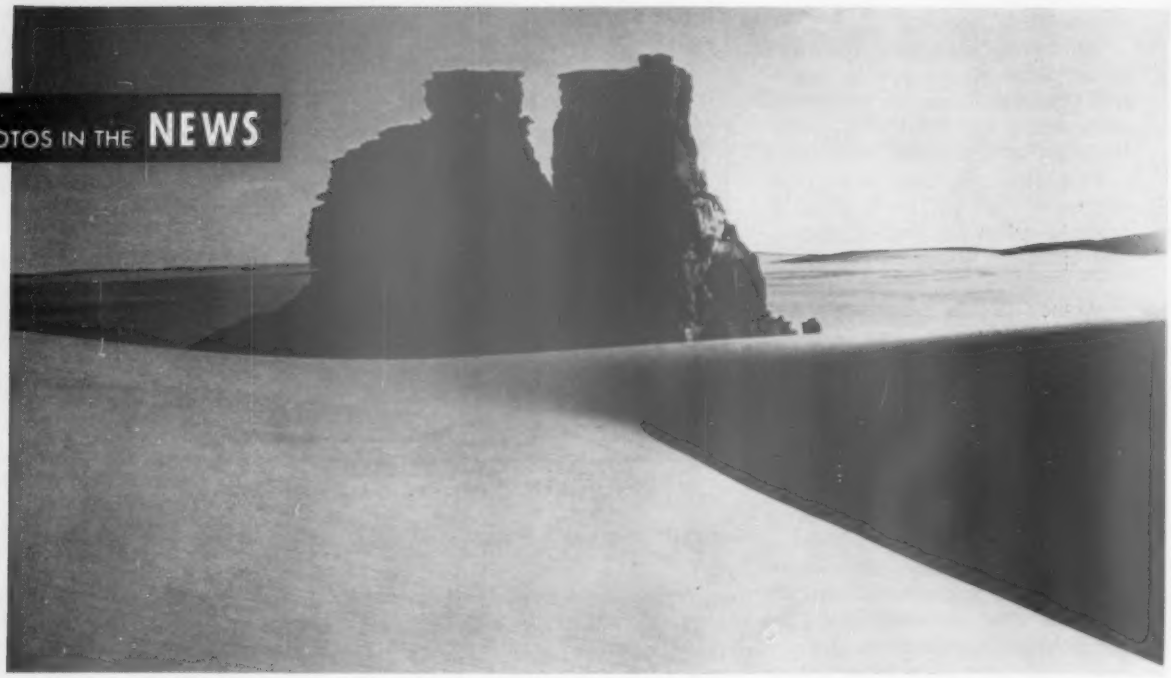
**Methyl chloride facilities** with capacity of 60 million pounds per year will be built at Lake Charles, La., by Continental Oil and Ansul Chemical. The plant will be located adjacent to Continental's refinery and Alfol plant. Completion is expected early next year.

### Also for Refiners . . .

**IN THE NEWS:** Underground-hydrant systems are proving the answer to airport jet-fueling problems (p. 103) . . . California Standard is planning a 20,000-bbl. refinery on the Kenai Peninsula of Alaska (p. 103) . . . Oil marketers are becoming more price conscious than ever before (p. 104) . . . Stanford Research Institute study shows asphalt roads more economical than cement ones (p 106).

**PLUS THESE TECHNICAL REPORTS:** Chemically cleaning process equipment (p. 125) . . . New plastic combats tank-bottom corrosion (p. 151).

PHOTOS IN THE **NEWS**



## Libyan Landmark

SANDSTONE outcrop—almost Gothic in its lines—forms a landmark in southern Libya's Block 74, where Pan American International plans to drill an exploratory test this year. The concession in Zone 3 covers 37,242 sq. km. Pan American holds concessions in six other blocks.

## Glass Paving

FOAMGLAS insulating blocks are laid for the base of one of three refrigerated-LPG storage tanks being built by Aramco at Ras Tanura, Saudi Arabia. Nearly completed tank is visible in background. Tanks will store output from nearby Aramco liquefaction plant with capacity of 4,000 bbl. of LPG daily. Later the LPG will be shipped by tanker.

## Miles of Rods

THREE MILES of sucker rods were hung in two strings, side by side, on this pumpjack at a California Oil Co. dual completion in Reedy Creek field, Jones County, Mississippi. Oil is lifted from 9,500 to 9,600-ft. sands. Tapered strings of ⅞ and ¾-in. rods are 7,960 and 7,979 ft. in length.

## Gasoline Alley

COMPETITION is tough all over, and particularly so along this street in Kano, Nigeria, where bicycles and bare feet are favorite kinds of transportation. When a motorist does show up, he has a wide choice of outlets—Mobil, Total, Shell, BP, Texaco, and Esso.

# Russians Push Work on Giant Gas Lines

- **Far-flung network to release more crude for export to free world.**

THIS is the key year in Russia's plans to make the ancient, Central Asian city of Bukhara the hub of the world's largest gas-pipeline system.

The first major section of a proposed 4,000-5,000-mile gas-transmission network has been completed. This 475-mile section runs from Dzharkak field, southeast of Bukhara, to Tashkent.

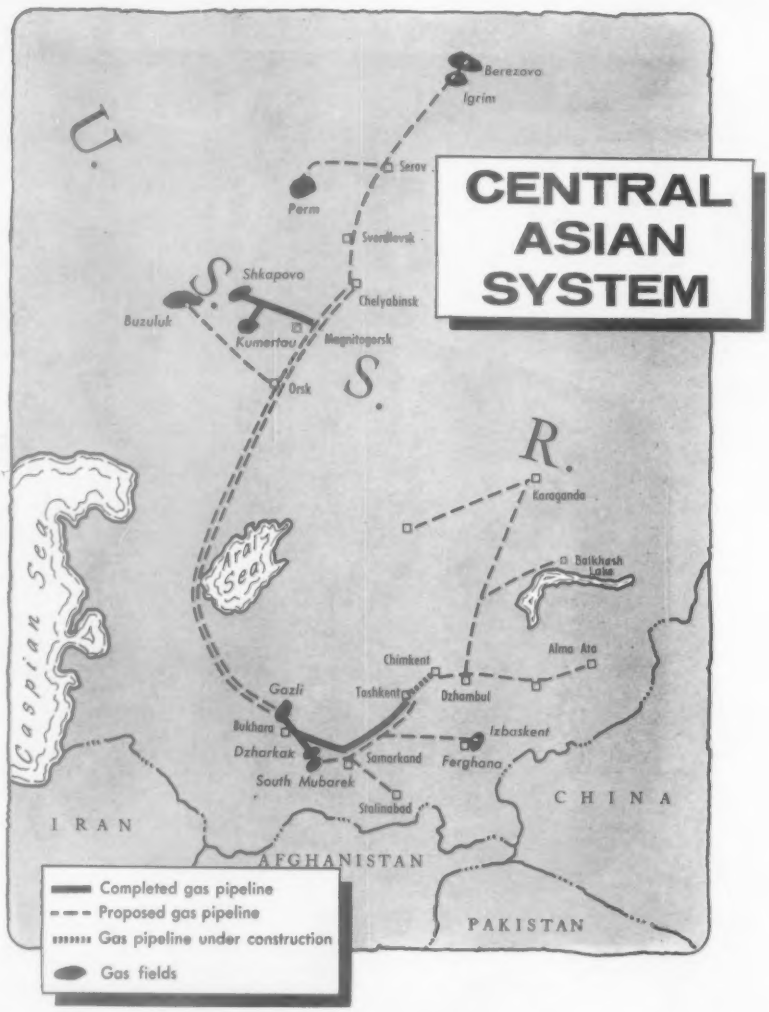
According to the Russians, this is only the beginning. They claim the planned system eventually will move limitless gas supplies into an area stretching from the Ural Mountains to a point near the border of China.

The big transmission project has been in the formative stage for quite a while (OGJ, Oct. 31, 1960, p. 71). But plans have been changed a number of times.

From the welter of Communist discussion and publicity, some basic ideas have emerged. Among them:

**. . . Parallel 40-in. lines** will run northward from Gazli field, near Bukhara, for 1,200 miles to Chelyabinsk. One of the lines will end at Chelyabinsk, and the other will continue for 150 miles to Sverdlovsk. Production from the Berezovo and Igrim fields, to the north, will flow down through Serov to Sverdlovsk. A shorter line originating in the Perm fields, west of the Urals, will tie into the Berezovo-Igrim-Sverdlovsk line at Serov.

**. . . The huge boost in gas** output in Central Asia will replace about 25 million metric tons of coal which currently must be brought into the Central Urals industrial area by rail from distant points. This coal will, in turn, replace oil being used inside Russia. The freed oil supplies, together with rising crude production, will give Russia more oil for export into free-world markets.




**Records in pipelining . . .** The two 40-in. lines will be the longest lines ever laid in the Soviet Union.

At present the longest gas pipeline in the world is the 2,340-mile line of Trans-Canada Pipe Lines, Ltd., which runs from Alberta to eastern Canada.

As far as diameter is concerned, the 40-in. Russian lines will be the world's largest.

By 1966, Russia plans to be moving 741 billion cubic feet of gas yearly through the two lines. That's more than the nation's entire gas production as recently as 1957.

Cost of the two lines is estimated by the Russians at 504 million rubles, or about $559 million at the new official exchange rate. The Reds give the aggregate length of the two lines as 2,772 miles and plans call for 21 compressor stations.

**Construction plans . . .** The Russians say the first 300 miles of the Gazli-Chelyabinsk line will be laid by the end of this year.

The entire 1,200 miles is due for completion by 1963. Then the Gazli-Sverdlovsk line is scheduled

to get construction under way.

Completion of the second half of the transmission system is expected by 1965. In that year, the total natural-gas output from Gazli and other fields in the Bukhara-Khiva depression is forecast at well over 750 billion cubic feet. This compares with 1.76 billion cubic feet produced in 1959.

Construction of the Gazli-Urals system has been delayed for two reasons.

For one thing, Soviet gas-industry officials couldn't agree on the route the line should take through the forbidding desert regions around the Aral Sea.

But the most compelling reason for the delay has been the inability of Russian steel mills to produce the 40-in. pipe required for the project. Officials now say the pipe can be produced on schedule.

**Dzharkak-Tashkent system . . .** When the Russians announced plans for the Gazli-Urals pipelines several years ago, the now-completed Dzharkak-Tashkent system was already under construction.

This system includes a 20-in. line from Dzharkak to Kagran, and 20 to 27-in. lines from Kagran to Samarkand and beyond. It has an annual capacity of 159 billion cubic feet.

Crews have already started extending the line beyond Tashkent to Chimkent and Dzhambul, with completion slated this year. From Dzhambul, a branch line is planned eastward to Frunze and Alma-Ata by 1965. Another branch line will run north to Balkhash, Karaganda, and Dzhezkazgan.

Like the bigger Gazli-Urals lines, the Dzharkak-Tashkent system will be fed by lines from a number of fields in the region.

A link between the Gazli-Urals system and the Dzharkak-Tashkent system wasn't mentioned at first. But work on such a connection started last year and was finished this month.

Soviet experts claim the entire Gazli-Urals system will be automated and will require less than half of the maintenance personnel now used on an 800-mile gas line from Stavropol to Moscow.

There will be no pipeline walkers, they say. Inspections will be made from helicopters.

## Venezuela's CVP Probes Rig Collapse

A COMMISSION has been appointed by the nationally owned Venezuelan Oil Corp. (CVP) to investigate the collapse of a rig during the drilling of the company's first well.

One laborer was killed when the derrick crumbled in Lake Maracaibo May 16. The mishap occurred after the Delta Drilling Co. crew had drilled to about 3,000 ft.

The well was spudded May 12. It offsets established production in blocks held by Shell and Phillips (OGJ, May 15, p. 119).

Another rig collapsed recently in the lake—a Kerr-McGee unit drilling for Signal 20 miles northeast of the CVP location. Two crewmen received fatal injuries in the April 8 accident.

Kermac has made repairs and is now drilling.

**Other gas . . .** The Russians have given very little publicity to plans for feeding additional gas into the industrial Urals area from some other fields being developed.

However, gas from Bashkiria's Shkapovo and Kumertau fields is reaching the metallurgical center of Magnitogorsk. The pipeline which moves this gas will be extended to connect with the Gazli-Urals system.

Another planned line from the Buzuluk field will meet the Gazli-Urals system at Orsk.

**Reserves . . .** The Russians are confident that the gas fields in the Bukhara region can satisfy demands made on them by all the lines now planned or under construction.

Estimates of Gazli reserves have varied widely, but all experts agree this region has Russia's largest gas reserves and some claim flatly they are the biggest in the world.

Yu. Bokserman, one of Russia's top gas industry authorities, cites a reserve figure of 17.65 trillion cubic feet as a Gazli minimum.

Since the first important gas strike at Setalan-Tepe, one of the Kagran group of fields 37 miles southeast of Bukhara, in 1953 the Russians have found at least 10 major gas fields in the Bukhara-Kiva depression. They estimate total reserves in the area, including Gazli, at 46 trillion cubic feet.

Gazli, discovered in 1956, is about 28 miles long and 6 to 10 miles wide.

The Russians have referred to six commercially productive gas horizons in the field with an over-all pay thickness of 984 ft. They say development costs are relatively low because the pays are shallow, from 2,000 to 3,900 ft., with high-porosity sandstone pays of good permeability.

Gazli wells flow from 17 to 35 million cubic feet daily with some wells producing from more than one pay making as much as 50 million cubic feet daily.

## Colombia Breaks Off Recovery Contract

COLOMBIA has broken off a 5-year-old contract under which an American oil company operated a secondary-recovery project in the old DeMares producing region.

Forest Colombian Corp., a subsidiary of Forest Oil Corp., Bradford, Pa., will receive a $6-million settlement for terminating the contract which had another 25 years to run.

Ecopetrol, the Colombian Government oil company, obtained the settlement sum from a New York bank, according to reports from Bogota.

The DeMares concession reverted to Ecopetrol in 1951 and it has been operating the producing facilities since then, but the fields are being depleted.

The contract with Forest called for a water-flood project financed jointly by the American firm and Ecopetrol.

Less than a year ago, Ecopetrol demanded that Forest break the contract. Ecopetrol said its management under the old government regime had no legal right to make the contract (OGJ, Aug. 22, 1960, p. 64).

# French Marketing in Britain

LURED by a petroleum demand which increased about 17% last year, the French are moving into the British Isles.

Six months ago the British motorist who had never made a trip to the continent would not have recognized the "Total" trademark of Cie. Francaise des Petroles.

Now it is showing up against such backgrounds as London's Big Ben. In the photo, a "Total" truck passes beneath the famed timepiece.

Total Oil Products (G.B.), Ltd. opened its first service station in London in December. The company now has 50 service stations in the London and Manchester areas and is pushing into other areas.

The French are breaking into the very competitive British market with a U. S.-type "service" station.

Total places heavy emphasis on service to the motorist.

British drivers are accustomed to seeing stations that were set up by placing a few pumps outside a garage.

The need to dispose of products refined from Saharan crude has promoted aggressive marketing by CFP in other European countries, too.

# Belayim Field May Go Into Suez Gulf

THE SINAI PENINSULA'S best oil field, Belayim, has apparently pushed its way into the Gulf of Suez.

First test of the offshore extension of Belayim, a little more than 5 miles from the peninsula, flowed at the rate of 1,890 bbl. daily of 31°-gravity oil from a pay section entered at 7,930 ft.

The well is being deepened in an effort to encounter more productive horizons.

The well was drilled for Cie. Orientale des Petroles d'Egypte (COPE) by the Italian company, SAIPEM. A mobile drilling barge was towed to the Gulf of Suez location from Ravenna in February (OGJ, Feb. 13, p. 68).

Reports from Egypt last week were incomplete, but the 31°-gravity oil tested in the marine drilling operation is of much better quality than the 22°-23°-gravity crude produced by more than 50 wells in the land area of the field.

Belayim and two other small Sinai fields, Abu Rudeis (Sidri), and Feiran, now produce about 40,000 bbl. daily. All are operated by COPE, controlled by International Egyptian Oil Co., Inc., which owns 51%. Egyptian agencies own the rest.

International Egyptian is owned jointly by Ente Nazionale Indrocarburi (ENI), the Italian Government company, and Petrofina.

# Argentine, Bolivian oil agencies get U. S.-backed loans

ARGENTINA and Bolivia have received capital transfusions from the United States with new government-backed loans to buy oil-producing equipment.

The loans represent—at least in part—an official change in the U. S. attitude toward government-controlled oil companies.

A few weeks ago the Export-Import Bank switched its policy and announced it was ready to offer government-credit backing for foreign sales of oil equipment (OGJ, April 3, p. 102).

Argentina's Yacimientos Petroliferos Fiscales got the first loan granted to buy $1.5 million worth of metering and crude-separation equipment from National Supply Co.

YPF made a 20% down payment for the equipment. The remainder of the purchase price was put up by the Export-Import Bank and Chase Manhattan Bank of New York.

Bolivia's Yacimientos Petroliferos Fiscales Bolivanos got a $6-million loan from the International Cooperation Administration for repair and replacement of equipment. This was part of a package deal of $10 million in aid announced by President Kennedy.

Both Argentina and Bolivia operated government-owned oil monopolies in the past.

Bolivia, where YPFB produces about 9,700 bbl. daily, opened the country to private oil companies 5 years ago and several companies are exploring for oil now.

Argentina followed suit less than 3 years ago with a series of contracts.

# Tankers Will Haul More Crude From Nigeria

NEW tanker-loading facilities will allow Nigeria to move 60,000 bbl. of crude daily into world markets by the end of this year.

This is triple the amount of oil now produced in the West African country.

Key to the step-up: A $3.5-million terminal which has just been completed at the mouth of the Bonny River.

But of almost as much importance is a new tanker channel across the Bonny Bar.

Shell-BP Development Co. spent 2 years on construction of the facilities. They also include:

**. . . A 12-in. pipeline** which links the terminal to the nearest producing field 18.5 miles away.

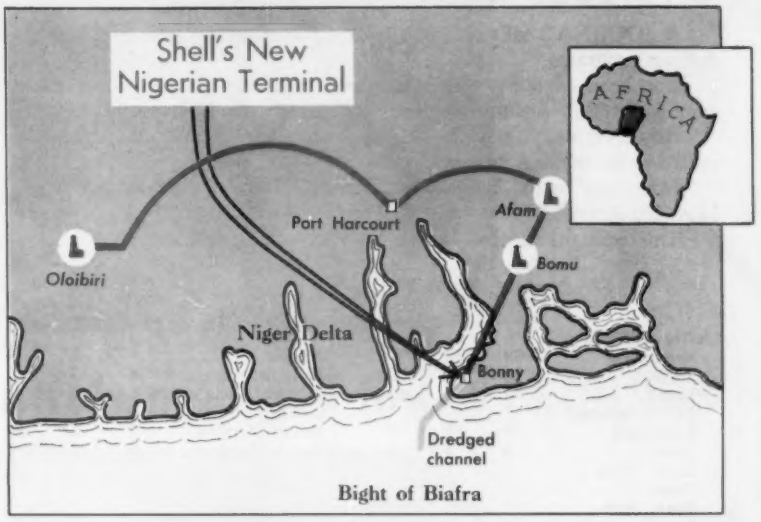
**. . . Three 110,000 - bbl.** storage tanks and a floating roof tank with 84,000-bbl. capacity.

**. . . Pumping facilities** which allow tanker loading at the rate of 10,500 bbl. an hour.

**The channel . . .** The new channel will permit T-2 tankers to make the passage to deep water at high tide fully loaded.

Before it was finished, tankers lifting Nigerian crude at Port Harcourt, 40 miles upriver, had to pass over the Bonny Bar half loaded and lightered from a small shuttle tanker outside the bar.

The channel—28-ft. deep, 10,000 yds. long, and 520 ft. wide—is the first step of a Shell-BP experiment.




If the channel can be maintained without further costly dredging for 12 months, it may be enlarged to accommodate bigger tankers.

Work on the channel started in 1959. The first test was made with a loaded tanker last February. Since then a number of tankers have made the passage successfully.

The work was done by a British-Dutch firm, Costain - Blankevoort Dredging Co., Ltd., and Raymond International.

Shell-BP started looking for Nigerian oil in 1937 and spent $42 million in the country before making a discovery at Oloibiri in 1956.

This field has proved disappointing, but the company has found several others. Best yet is Bomu, which also acts as a gathering station for the new terminal.

Now that it has access to crude in the delta region, the company expects to increase production steadily.

An official target of 200,000 bbl. daily by 1970 has been set. But Shell-BP says this is a conservative estimate.

## Offshore Nigeria Eyed

MOBIL Exploration Nigeria, which has drilled three dry holes in Nigeria, now wants to get its feet wet in the continental-shelf area offshore.

The company has applied for two exploration tracts covering about 2,000 sq. miles of the Niger Delta area east of Port Harcourt. These applications have been accepted by the Nigerian Government, subject to agreement on terms.

Gulf Oil and American Overseas (Caltex) also have applied for offshore tracts.

# Iran Has 26,000-Bbl. Well

THE BIG Kurait structure, southeast of the little Iranian town of Ahwaz, is finally beginning to fulfill its promise.

Iranian Oil Exploration & Producing Co. revealed last week that Ahwaz 8 has gone on production at the rate of 26,000 bbl. daily, a creditable flow even for Iran.

It is the first big producer drillers have been able to coax out of Ahwaz in nearly 46 years of trying.

Ahwaz 6, now producing 6,800 bbl. daily, furnished the oil world with some pyrotechnics in the spring of 1958 when it blew out, caught fire, and blazed for 65 days before it was finally controlled by Myron Kinley.

Drilling was finally resumed in the same hole and the well was carried to 13,210 ft. This well established the existence of a productive Cretaceous limestone underlying the prolific Oligomiocene Asmari, but it was completed in the Asmari.

Ahwaz 7 has also been completed as an oil well, but has not yet been put on production by the international consortium's producing company.

The first five wells drilled on the structure between 1916 and 1958 were abandoned. The first four had mechanical problems downhole and the fifth found the Asmari to be water-bearing.

# Overseas Drilling Moves Up

A JOURNAL tally shows a spring pickup is continuing in foreign drilling programs.

The level of activity still is below last year. In mid-May, there were 837 rotary rigs on new wells compared with 854 last June.

However, activity is up slightly from October. At that time 828 outfits were making hole.

Operators in the United States had 1,740 rotaries on new wells May 15. Another 79 were in action in Canada.

This brought the free-world total to 2,656 rigs.

| | May 1961 | Oct. 1960 | June 1960 |
|---|---|---|---|
| **LATIN AMERICA** | | | |
| Argentina | 109 | 109 | 106 |
| Bolivia | 14 | 15 | 10 |
| Brazil | 55 | 39 | 48 |
| Br. Honduras | 1 | ... | ... |
| Colombia | 19 | 18 | 19 |
| Chile | 6 | 4 | 4 |
| Costa Rica | ... | 1 | ... |
| Cuba | ... | 1 | 1 |
| Dom. Rep. | 1 | 1 | 1 |
| Ecuador | 6 | 3 | 3 |
| Guatemala | 1 | ... | 1 |
| Mexico | 144 | 144 | 134 |
| Panama | 1 | ... | ... |
| Peru | 11 | 11 | 11 |
| Trinidad | 24 | 25 | 28 |
| Venezuela | 29 | 43 | 42 |
| Total | 421 | 414 | 408 |
| **MIDDLE EAST** | | | |
| Bahrain | 1 | 1 | ... |
| Iran | 13 | 14 | 16 |
| Iraq | 7 | 11 | 11 |
| Israel | 4 | 4 | 6 |
| Jordan | ... | 1 | ... |
| Kuwait | 4 | 3 | 2 |
| Neutral Zone | 6 | 6 | 6 |
| Qatar | 1 | 2 | 2 |
| Saudi Arabia | 2 | 3 | 3 |
| South Arabia | 2 | 2 | 3 |
| Syria | 2 | 2 | 2 |
| Turkey | 11 | 11 | 11 |
| Total | 53 | 60 | 62 |
| **WESTERN EUROPE** | | | |
| Austria | 9 | 9 | 9 |
| France | 28 | 30 | 50 |
| W. Germany | 100 | 100 | 100 |
| Greece | 1 | ... | ... |
| Italy | 31 | 31 | 31 |
| Netherlands | 4 | 4 | 4 |
| Spain | 7 | 6 | 8 |
| Switzerland | 1 | 1 | 1 |
| U. K. | 4 | 4 | 4 |
| Total | 185 | 185 | 207 |
| **AFRICA** | | | |
| Algeria | 41 | 38 | 53 |
| Angola | 3 | 3 | 3 |
| Egypt | 18 | 13 | 11 |
| Senegal | 3 | 1 | 3 |
| Gabon | 3 | 6 | 6 |
| Gambia | 1 | 1 | 1 |
| Libya | 35 | 35 | 32 |
| Madagascar | 1 | 1 | 2 |
| Middle Congo | 1 | 1 | 1 |
| Morocco | 1 | 1 | 1 |
| Nigeria | 3 | 5 | 5 |
| Spanish Sahara | 1 | 1 | ... |
| Somalia | 2 | 2 | 2 |
| Kenya | 1 | ... | ... |
| Tunisia | 1 | 1 | 1 |
| Total | 115 | 109 | 121 |
| **ASIA-PACIFIC** | | | |
| Australia | 5 | 4 | 4 |
| British Borneo | 2 | 2 | 2 |
| Burma | 4 | 3 | 3 |
| Formosa | 1 | 1 | 1 |
| India | 17 | 8 | 6 |
| Indonesia | 12 | 15 | 15 |
| Japan | 15 | 15 | 15 |
| New Guinea (inc. Papua) | ... | 1 | 1 |
| New Zealand | 2 | 2 | 1 |
| Pakistan | 3 | 5 | 5 |
| Philippines | 1 | 3 | 2 |
| Timor | 1 | 1 | 1 |
| Total | 63 | 60 | 56 |
| **GRAND TOTAL** | 837 | 828 | 854 |

NOTE: Estimates are made where complete up-to-date reports are lacking.

# First Israeli Gas Line Inaugurated

ISRAEL'S first natural-gas transmission line went into operation last week when Levi Eshkol, Israeli Minister of Finance, turned a valve which sent the first gas from Zohar and Kidod fields toward a potash plant on the Dead Sea, 18 miles to the east.

The 6-in. line will make initial deliveries of 2,000 M.c.f. daily to Palestine Potash. Gradually the flow will be increased to 85,000 M.c.f.

Other contracts are being negotiated with a phosphate company, a textile firm, and for an atomic reactor now under construction.

The Israeli Government will set the price of the gas by a complicated formula relating it to the calorific value of fuel oil.

The government has bought a 2-year output of the two small fields at a wellhead price of about 28.5 cents per M.c.f. from Naphtha Israel, developer of the field. Present plans call for the government to pay the company $100,000 per month during the 2-year period for all the gas shipped.

The pipeline itself will be operated separately by a joint private-government company. Three exploration companies and three marketers will have shares in this firm along with the government. Ownership of the pipeline operation has not yet been decided.

## BP Refinery Expansion Due

FOSTER WHEELER, Ltd., will design, engineer, and build four new units in a lubricating-oil complex to be added to British Petroleum's Kwinana refinery in Australia at a cost of more than $15 million.

Foster Wheeler will carry out the construction project with Constructors John Brown (Australia), Pty., Ltd.

The project will include a vacuum distillation unit, a furfural extraction unit, a MEK-toluene dewaxing unit, and a Ferrofiner. All are expected to be on stream at the end of next year with an annual output of 100,000 tons.

# Mobil has share in West Germany's latest discoveries

WEST GERMANY'S two latest field discoveries have little in common except part ownership by Mobil Oil.

No. 1 Assling, 21 miles southeast of Munich, tested at the rate of 900 bbl. of high-gravity oil daily from below 11,312 ft.

The other wildcat, modest when compared to the Bavarian find, was brought in near Hamburg and is regarded as a major extension of Gross-Hamburg field. Almost a mile west-southwest of the Gross-Hamburg discovery, the new well—Sottorf-East No. 1—tested 20 bbl. daily from a Dogger sandstone section found between 6,786 and 6,800 ft. Both are Mobil-Preussag wells.

Dry chemical stream is aimed at hot blazing oil from high-pressure line.

# New Fire Boss controls major oil fire in SECONDS

Now at seat of fire, dry chemical rapidly breaks down combustion, kills fire in 12 seconds.

**Dry chemical** is the ideal agent for fighting "waterproof" fires—oil, gas and electrical. But the success of dry chemical depends on bringing large volumes into play, *fast.*

**Seconds count.** The new Fire Boss equipment shown here applies 50 lbs. per second. Other units apply over 150 lbs. per second. With deluges of this magnitude, major Class B fires are extinguished *rapidly,* saving valuable equipment.

**How Fire Boss works:** the sphere of dry chemical is inverted at the touch of a lever. Nitrogen thoroughly fluidizes the dry chemical and propels it smoothly and powerfully—for distances up to 160 feet. The man at the nozzle advances confidently behind a wall of dry chemical.

**Fire Boss equipment** is available skid- and trailer-mounted from 1000 lb. to 3500 lb. capacities, and in crash-rescue trucks from 2500 to 7000 lb. capacities. Combination dry chemical-water foam, -water fog, and -water units are available to meet almost any fire hazard. Heat-activated systems provide automatic protection at unmanned or extremely hazardous locations.

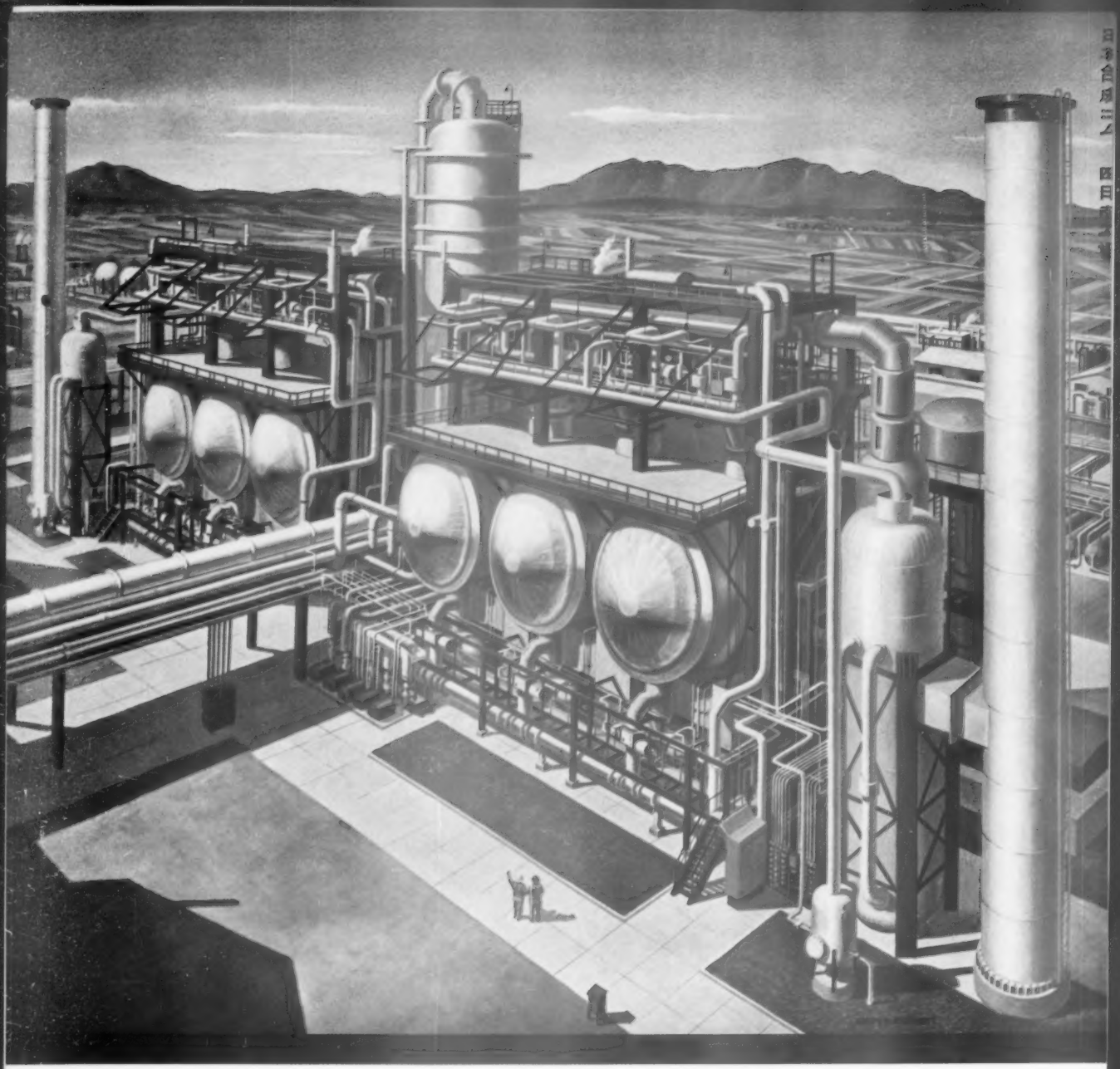
**Insurance coverage** alone cannot indemnify you against loss of profits and the "hidden" losses caused by a fire. Take charge of your own fire problems. Protect your men and equipment with dependable, effective Fire Boss. Protect profit dollars, too.

**Write for detailed technical literature** and ask to see the amazing color film demonstration of Fire Boss in action. Fire Control Engineering Company, 6000 Camp Bowie Blvd., Fort Worth 16, Texas.

**FIRE BOSS**®

**Insurance protects your investment...Fire Boss protects your profits**

Fire Boss equipment is patented and U.L. approved.



## ONE-STEP BUTADIENE PRODUCTION COMES TO JAPAN

Japan Synthetic Rubber Co., Ltd., is now using the flexible, single-step Houdry Dehydrogenation Process. This new plant, at Yokkaichi, Japan, is the first butadiene plant in Asia. It is designed to produce 25,000 ton/yr of butadiene from butane, using Houdry Dehydrogenation Catalyst. Feed stock may range from straight run butane to complex mixtures from steam cracking operations. Reactors are arranged in two parallel systems which can be operated independently. Versatility of the process allows easy adaptation to efficient production of butenes and other olefins. A complete process description may be obtained on request, from Houdry Process Corporation, 1528 Walnut Street, Philadelphia 2, Pa.

* HOUDRY PROCESSES

*Houdry means Progress . . . through Catalysis

What you need to know about

# Chemical Cleaning

## of processing equipment

BY H. C. BOZEMAN
Gulf Coast Refining Editor
AND PAUL A. FINN
Wyandotte Chemicals Corp.

IN-PLACE chemical cleaning, the act of contacting fouling deposits with effective chemical solutions, is attractive for process equipment. The deposits are safely freed and flushed out. This technique reduces down time, lengthens onstream time, removes fouling deposits, and cuts costs.

Chemical cleaning is used for process-side cleaning, as well as removal of hard-water deposits. But it cannot free plugged tubes or pipe. Neither can it be used to dissolve carbon or coke, because no solvent is available for this service.

**Keys to successful chemical cleaning** are planning and field control. Thorough planning of a chemical-cleaning job is the first step to success, and good field control is necessary to assure it. The importance of these two steps cannot be overemphasized.

Chemical cleaning can be used as a routine maintenance practice, although some situations which require special planning and techniques will occur.

This section is devoted to in-place chemical cleaning of refinery and petrochemical equipment, but many of the procedures outlined are suited equally well for soak-and-salvage cleaning and other maintenance use of chemicals.

PART 1

## Planning in-place chemical cleaning

PLANNING is the first step of a chemical-cleaning job. It is perhaps the most important step because this is where it is determined whether a proposed job can be done.

It is necessary to understand the different types of scales and fouling deposits. Scale type tells much about the final choice of cleaning solution, so gathering a representative sample is critical. Performance testing of the sample shows which chemical or combination of chemicals to use, length of cleaning cycle, and efficiency to expect.

Comparison of cost and down-time requirements for chemical cleaning and manual cleaning will then show a payout in favor of one or the other method. If the economics are attractive to chemical cleaning, actual job procedures can be planned.

Many planning phases can be done concurrently. However, before starting any field work, it is important to know how effective the chemical-cleaning job will be, based on performance tests.

It should not be assumed that all heat-exchange equipment can be cleaned by in-place chemical circulation. Construction features as well as the nature and amount of fouling may very well rule out even attempting in-place chemical cleaning.

Square-pitched tube bundles enhance the possibility of successful in-place chemical cleaning. However, triangular-pitched tube bundles often make cleaning difficult, if not impossible, because closely placed tubes prevent deposits which are freed from the base metal being flushed out of the tube maze.

**The chemical-cleaning group** should be organized in either of two ways—a central group to serve all operating and maintenance departments, or a dispersed group where

each zone has its own specialist in chemical cleaning.

A central group is a better clearing house for exchanging chemical-cleaning information. A successful chemical-cleaning job in one zone may help solve problems in others.

A dispersed group should be familiar with techniques of chemical cleaning and should exchange information to increase their specialized knowledge.

### Scales and Deposits

Scales and deposits found in refinery equipment are divided into three classes for identification and choice of general cleaning procedure. These are: inorganic, organic, and mixtures of the two.[1]

There is a difference in meaning between the words "scale" and "deposit." Scale refers to a hard, thin covering or coating. An example is the oxide coating on rusted pipe or mill scale on pipe and plate coming from the mill. Deposit refers to sedimentation such as products in the process fluid that are laid down on process-equipment surfaces.

**Inorganic deposits** most often occur on the water and steam sides of process equipment. Hard-water deposits are one example.

These deposits usually are mixtures of specific chemical compounds, and each may be identified by analysis. Each compound is composed of metal cations (positive ions) and anions (negative ions). Cations in the scale may come from either the equipment itself or the fluids passing through the equipment. The fluids contribute the anions.

Some of the common cations are iron, copper, zinc, potassium, manganese, sodium, magnesium, and calcium.

Some of the common anions are carbonate, bicarbonate, sulfate, sulfide, chloride, oxide, phosphate, hydroxide, and silicate.

Many inorganic deposits are water insoluble. In general, they are removed by conversion to compounds soluble in the cleaning solution, or by dispersion.

**Organic deposits** usually are found on the process side of equipment. Their nature and composition depend on temperature, pressure, and feed stock. They vary from benzol-soluble deposits to hard, cokelike deposits.

Coke deposits are almost impossible to remove by chemical cleaning unless held together by a "binder" which is soluble or dispersible in the cleaning solution.

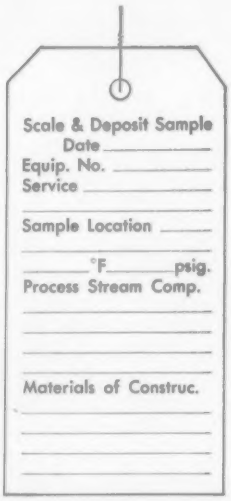
**Mixtures** are complex deposits of both inorganic and organic ingredients, and are found on either the water or process sides of equipment. On the water side they are found when hydrocarbons are introduced by oil leaks from broken exchanger tubes, and pump, and compressor packing glands. On the process side the organic deposits may be mixed with iron and copper sulfides which are corrosion products.

### Samples

Unless it is impossible to do so, a chemical-cleaning job should not be started without taking a sample of the scale and deposit, and making performance tests.

Samples should be obtained carefully. Here are some tips:

1. Remove the sample in chunks, right down to the metal surface. This assures that all strata of a deposit are available for tests.
2. When possible, procure a section of the tube or equipment containing the deposit. Powdered samples are helpful if chunks or tube samples cannot be obtained.
3. The sample should represent that part of the scale and deposit hardest to remove. From heat exchangers, the heaviest deposits occur near the outlet. Hardest deposits in boilers usually are found on the hottest tubes. Samples from towers should come from the bottom, middle, and top.




**USE A TAG** to identify samples. Record pertinent information to help analysis later. Fig. 1.

**Care of samples.** After obtaining the sample, preserve it in as near original condition as possible. Put it in a closed container, such as metal can or glass bottle with tight closure, to prevent contact with air and evaporation of the lighter hydrocarbons.

Label the sample, Fig. 1, for future identification.

Select samples every time process equipment is opened for inspection or repair. They are an invaluable guide when equipment needs chemical cleaning. Resample whenever the equipment is down again for maintenance.

Deposits that occur during one period of operation may differ from another because of changes in operating conditions or feed stocks.

In some cases it is absolutely necessary to do chemical cleaning without first obtaining a sample. The chemical and physical composition of the process streams can give a very good insight into the possible nature of fouling deposits. For example, when sour feed stocks are processed, it would be well to expect a deposit with high percentage of iron sulfide.

### Analysis

**Visual inspection** is the first analysis step. This determines such things about the scale and deposit sample as density, porosity, hardness, and friability.

Are deposit layers of different materials? If so, the solution needs to react with all the deposit, to remove it. Is the sample oily or cokelike, etc.?

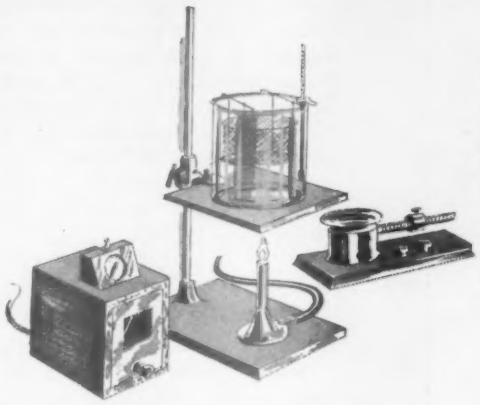
**Chemical analysis** is made by rigorous and abbreviated methods of both qualitative and quantitative analysis.

An analysis that finds the major constituents helps narrow the choice of possible chemical solutions. Only in rare cases is it necessary to run a complete analysis.

X-ray diffraction requires only a small sample and does not destroy it during analysis. If X-ray diffraction does not identify completely the constituents, other spectroscopic analyses can be used.

### Solution Selection

Performance tests to select the



**PERFORMANCE TESTS** are made in this equipment (left to right): small drying oven, 1,000-ml. beaker, 20-mesh stainless-steel or monel basket capable of holding a 100 to 300-g. sample, thermometer with a range of 32° to 250° F., bunsen burner, laboratory stands and clamps, and balance. Fig. 2.

chemical solution will reveal the technical feasibility of the proposed job. Evaluation of the sample in one or more chemical-cleaning solutions will compare the efficiency of deposit removal. Corrosion is minimized by selecting a chemical that is compatible with the materials of construction.

**Performance testing** should be uniform from test to test for reproducible results. The equipment needed to make tests is shown in Fig. 2. It is available from the plant's laboratory stockroom or a laboratory supply firm.

**The test technique** is as follows:

1. Place 100 to 300 g. of the sample in the basket. Note the basket's tare weight.

2. Immerse the basket in the test solution and raise the temperature to the recommended operating range.

3. Leave the sample in the solution until definite conclusions can be drawn. The minimum time usually is 1 hour. Remove the basket from the solution periodically to check reaction rates and decomposition. Note the amount of gases evolved and test for type.

4. Upon conclusion of the immersion period, remove the sample and gently rinse in water.

5. Dry the remaining sample in an oven and reweigh it to find the weight loss. The amount of sample weight loss gives an indication of the cleaning efficiency to expect from the chemical solution.

When deposits contain a high percentage of coke and carbon, the weight loss will probably be small indicating that cleaning might not be very effective. However, the cleaning job can be successful if there is enough soluble binder holding the coke particles together and the particles are small enough to be flushed out.

If the cleaning solution dissolves the binder, then the hydraulic action of the circulating solution may wash out the coke particles.

6. Make a total-destruction crucible test of the dried sample to show the per cent coke.

7. Evaluate corrosion potential during the performance test. While the basket is immersed in the chemical solution, also immerse weighed metal test coupons. Visual examination and reweighing will reveal any corrosion that occurred during the performance test.

Experience factors are used to find the circulating time of the cleaning solution. Based on the cleaning time found in the performance tests, the factor for heat exchangers usually is about 5, and for towers about 9.

Example: Sample completely dissolved in 45 minutes. Circulating time for heat exchangers would be about 3 hours, 45 minutes, and for towers, 6 hours, 45 minutes. Actual job time might be less because of the effect of fluid velocity in sweeping out debris.

Example: Sample was 75% dissolved at the end of an hour and further reaction had stopped. For heat exchangers circulating time would be 5 hours and towers 9 hours, but if the solution did not sweep out undissolved material, only about 75% would be removed.

When deposits are allowed to become too thick or carbonized, it becomes increasingly difficult to obtain complete cleaning.

**Selecting the test solution.** The type of scale and deposit, inorganic or organic, plays an important role in solution selection. In general, inorganic deposits are removed with acidic materials, organic deposits with alkaline materials, and mixtures with acid or alkaline cleaners, and emulsifiable solvents.

Within each deposit group there is a wide range of possible solvents. Inorganic deposits usually can be removed with inhibited mineral acids or acid cleaners containing detergents. Similarly, a wide range of possible chemicals is available to remove inorganic, organic, and mixture deposits, Table 1. This is only a partial list; experience will show which materials are suited for particular cleaning jobs.

**TABLE 1—CHEMICALS FOR REMOVING INORGANIC, ORGANIC, AND MIXTURE DEPOSITS**

| FOULING DEPOSITS | CHEMICAL AGENTS AND SOLVENTS |
|---|---|
| **INORGANIC** | |
| Iron oxide<br>Iron sulfide<br>Calcium carbonate<br>Copper oxide<br>Calcium bicarbonate<br>Copper sulfide<br>Silicates | Mineral acids, organic acids, acid salts, and proprietary acid cleaning compounds |
| **ORGANIC** | |
| Light hydrocarbon ends<br>Oils<br>Tars and asphaltic deposits<br>Carboxyl acid groups<br>Coke and derivatives | Caustic soda, soda ash, sodium silicates, sodium phosphates, and proprietary alkaline cleaning compounds |
| **MIXTURES** | |
| Oils, wax, tars, or coke in combination with iron oxide, iron sulfide, calcium carbonate, magnesium sulfate, and resin polymers | Solvent emulsions, cresols, chlorinated hydrocarbons, and proprietary acid and alkaline cleaning compounds |

Chemical Cleaning
Job Cost Estimate

Equipment No. _____ Date: _____

Service: _____ Unit: _____

Remarks: _____

Historic Manual Cost: $_____ Historic Manual Hours Downtime _____

Overhead $_____

Labor (including payroll burden)

Fabricate temporary pipe _____ Hr.
Install and Remove
1. Blinds _____ Hr.
2. Temporary pipe _____ Hr.
Open, Inspect, and Close _____ Hr.
Total _____Hr. @$_____ per Hr. $_____

Material

Temporary Pipe
Valves
Fittings
Pipe
Hose _____
Total $_____

Chemicals

_____Gal. HCl @ $_____per gal.
_____Qt. Inhibitor @_____per qt.
_____drums_____ @$_____per drum
_____drums_____ @$_____per drum
Total $_____

Chemical Cleaning Contractor

Hourly Rate $_____X_____ Hr.
Standby Rate $_____X_____ Hr.
Lump Sum _____

Chemical Cleaning Cost _____Hr.
Chemical Cleaning Downtime Requirements $_____

**DIRECT MAINTENANCE COSTS** of chemical cleaning are easily estimated. Fig. 3.

Performance tests with several chemical solutions will aid in selecting agent that does the job at lowest cost.

### Action of the Chemical Solution

Chemical action during chemical cleaning may be very complex. Many forms of chemical activity often occur simultaneously. The major ingredient reacts with the deposit; inhibitors protect exposed bare metal surfaces. Wetting agents insure intimate contact of main reactant with deposit. Emulsifying agents take oils and greases into aqueous solution. Organic solvents dissolve oils and other hydrocarbons. These are a few of the chemical actions.

Here are some typical reactions of various classes of chemicals on typical scales and deposits.

**Inorganic scales and deposits.** Inhibited hydrochloric acid is used widely to remove inorganic deposits and will be used here to illustrate some of the chemical actions. It is only one of the acids that can be used for chemical cleaning. Sulfamic acid is another reagent that is finding increased use in chemical cleaning, especially when formulated with inhibitors and wetting agents.

Sulfuric and phosphoric acids also are used, but have disadvantages which preclude wide use. Sulfuric acid, while economic, is dangerous to handle and has high heat of dilution. It forms insoluble calcium sulfate where calcium salts are present.

Phosphoric acid also presents some handling hazards to personnel and may form insoluble calcium phosphates where calcium salts are present. Nitric acid is dangerous to handle because it causes serious burns. It dissolves iron and steel, evolves poisonous nitrous oxide fumes, and is almost impossible to inhibit effectively.

Inorganic scales and deposits are classed as water insoluble. Acids are used to convert them into water-soluble compounds.

Inhibited hydrochloric acid is used widely to remove water scale. Other chemical solutions are used to remove those deposits not soluble in hydrochloric acid. Sometimes it is necessary to clean first with an alkaline compound before the acid will effectively remove the scale.

Hydrochloric acid reacts with a metal carbonate thusly: (M refers to the metal cation).

$$MCO_3 + 2HCl \rightarrow MCl_2 + CO_2 + H_2O \quad (1)$$

Metal oxides and hydroxides of iron, copper, zinc, and manganese may occur in the scale and deposit. These are removed usually by reaction with hydrochloric acid, although the reaction is slower than with carbonates.

$$M_2O_3 + 6HCl \rightarrow 2MCl + 3H_2O \quad (2)$$

The metal chloride usually is soluble in the acid. However, cuprous oxide is rather insoluble in dilute hydrochloric acid.

Free chlorine, which is very corrosive, is liberated when manganese dioxide dissolves in hydrochloric acid. When manganese is detected, a suitable reducing agent that reacts with manganese and prevents formation of chlorine should be added.

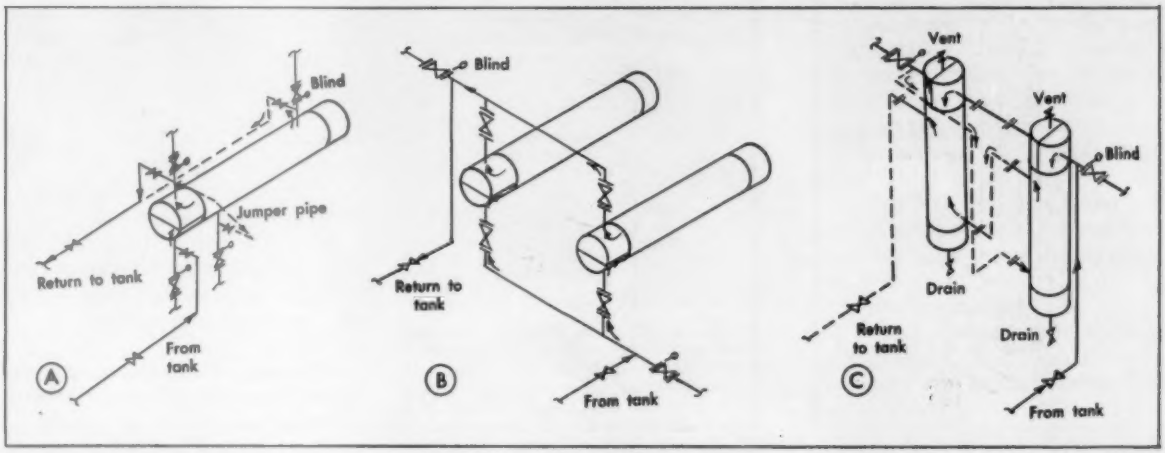
Sulfides of iron, copper, and zinc are found in scales and deposits. Their reaction with hydrochloric acid which liberates hydrogen sulfide gas is as follows:

$$MS + 2HCl \rightarrow MCl_2 + H_2S \quad (3)$$

**Organic deposits.** Heavy-duty alkaline compounds containing wetting agents and detergents emulsify or digest organics. These alkaline compounds are used in hot aqueous solution. Other cleaning agents include solvent emulsions, straight mineral solvents, and chlorinated solvents.

**Mixtures.** Process-side deposits generally are organic in combination with iron and copper sulfide corrosion products. On the water side, inorganic deposits often contain silicates, oil, and grease.

Several cleaning procedures are used because of the wide nature of these deposits. In some cases, the equipment is precleaned to remove "barrier" (oil and grease) deposits




**PIPING FOR CLEANING** a single horizontal heat exchanger. Install blinds to isolate. Solid lines for tubes only. Use jumper pipes (dashed lines) to clean both tube and shell side in series. Circulate: (1) In bottom, tube side. Out top of tube side. (2) In bottom, shell side. Out top of shell side. Never circulate into the shell side first. Never circulate from the top of the exchanger to the bottom. Fig. 4a.

**MULTIPLE HEAT EXCHANGER PIPING.** Use existing headers to shorten amount of temporary pipe. Solid lines show circuit for parallel cleaning of tube side. This circuit is all right for simple HCl removal of hard-water lime scale. It would not work for removing product side deposits. A series hookup would be preferable. Fig. 4b.

**VENT HIGH POINTS** and drain low points. Solid lines show tube-side circulation. Tubes are two-pass, and shells are single pass. Note that the circulation is through both tube sides before going into the shell side. Fig. 4c.

before removing the inorganic deposits. Other cases call for a solvent emulsion, and still others need an alkaline cleaner alone or in combination with a solvent emulsion.

**Corrosion.** It is possible for corrosion to occur during a chemical-cleaning job. Selecting the proper cleaning solution to avoid corrosion is as important as selecting the solution to dissolve the scale and deposit.

Even fresh chemical-cleaning solutions can cause corrosion, and evaluation of all laboratory data is a prime step. However, laboratory data can serve only as an initial guide.

In the field, the corrosion problem can be altered by the presence of undissolved deposits and dissolved reaction products.[2] Corrosion testing during the performance tests (see Test Technique No. 6) is a convenient corrosion-evaluation method.

Here are some specific corrosion tips:

**Carbon steels** are resistant to many inhibited acids at elevated temperatures when the temperatures are within the inhibitor's effective range. Small changes in steel composition may alter the effectiveness of the inhibitor at any temperature.

Long uncontrolled exposure of carbon steel to boiling alkaline solutions can result in caustic embrittlement. Organic solvents and emulsion cleaners have little effect on steel.

**Cast iron** can be cleaned with the same types of chemical solutions used for steel, but at lower temperatures.

**Stainless steel** (chrome nickel and chrome steels) are attacked by the same inhibited hydrochloric acids that are safe on carbon steels.

**Aluminum and its alloys** are corroded by caustic soda-base cleaning solutions. Alkaline, silicated cleaning compounds with proper inhibitors do an excellent job of removing organic oil deposits from aluminum safely.

**Galvanized iron** ordinarily should not be cleaned by strong alkalies or inhibited acids because the zinc coating will be removed.

**Copper** in the process system, particularly as a catalyst, often complicates chemical cleaning. Copper sulfide is highly insoluble.

Some complex copper deposits can be broken down by series treatment with alkaline solutions followed by acids. However, copper usually has plated the surrounding carbon steel. Copper-plated steel may corrode many times faster than ordinarily because of galvanic effects.

Some plants circulate ammonium hydroxide through the process equipment to free it of chemically deposited copper plate. Thorough water rinsing always follows each stage of chemical circulation.

### Economics

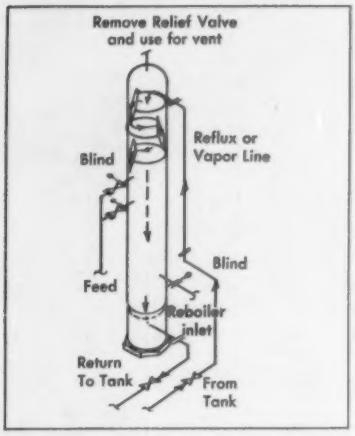
Direct costs may be estimated as shown in Fig. 3. Compare the estimated chemical-cleaning cost and down-time requirements with manual maintenance cleaning costs and down time. The manual cost should include such costs as removing exchanger bundles, drilling the tubes, and returning the exchangers to stock.

Include these items when estimating direct chemical-cleaning costs:

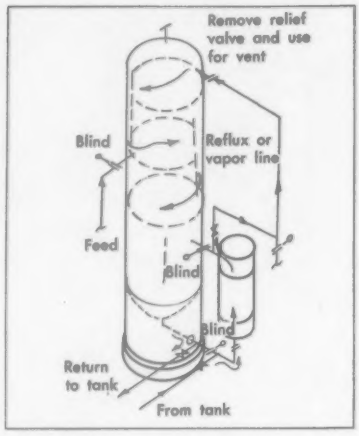
- Direct labor. Estimate the man-hours required to prepare the equipment for chemical cleaning and return it to service after circulation. Add payroll burden to the bare labor cost.
- Material. Estimate the cost of temporary piping.
- Chemicals. The amount of chemicals required can be calculated from the equipment's internal volume and initial chemical concentration. Include a surge volume of 1 minute's pump circulation rate.

For exchangers and drums, compute for complete fill. For towers with circulation from the top to bottom, find the amount of fluid to cover the bubble caps and fill the downcomers. For bottom-to-top circulation, find the internal volume.

Chemical-cleaning contractors charge by the hour or job. If specified in the purchase order, they fur-




**TOWER CLEANING** with circulation from top to bottom. Isolate from adjacent equipment. If trays are plugged and/or to clean sidewalls complete fill from the bottom is necessary. Fig. 5a.




**TOWER CLEANING** from top to bottom in series with reboiler (tube side only). Note reboiler connections prevent it from becoming a trap for debris. Fig. 5b.

nish the chemicals, also. Cost of standby time depends on each contractor's practice, but may be different from the basic hourly rate.

Use comparable costs when plant crews use plant equipment to do the circulating.

**Other benefits.** Direct maintenance cost show the short-term economics of chemical cleaning. Long-term economic benefits are realized from (1) duration of higher heat-transfer coefficients compared to mechanical cleaning and their effect on fuel requirements; (2) longer length of runs between cleanings compared with mechanical methods; (3) higher throughputs with chemical cleaning; and (4) longer life of equipment because of less mechanical handling.

Drilling tube interiors and sawing the deposits from the shell side is both costly and time consuming. Quite often, both tube and shell-side surfaces can be chemically cleaned in less time than it takes to pull the tube bundle. The economics become even more obvious when several pieces of equipment are cleaned simultaneously.

Thorough chemical cleaning with complete removal of fouling deposits down to the metal surfaces removes the base for subsequent deposit buildup. This lengthens on-stream time.

## Piping

The practice is to clean heat-exchanger tubes and shell with flow from bottom to top, Fig. 4. This procedure ensures complete filling and easy venting of any gas generated during cleaning. Flush, first from bottom to top, and then reverse flow.

Towers can be cleaned by two methods. The more common is circulation from the top to bottom, Fig. 5a, which is useful only when trays and downcomers are not plugged. The sidewalls are not completely contacted. When complete sidewall cleaning is required or the tower is plugged, circulation from the bottom is necessary.

Towers are cleaned in series with their connected reboilers in many cases. Always circulate through reboiler, bottom to top, and then into the tower top which keeps the reboiler from being a trap for removed deposits.

**Piping hints.** Keep length of temporary piping and hoses to a minimum. Lay hoses on the ground; do not suspend between connections. Park cleaning equipment as close as possible to process equipment. Provide steam, utility water, and firewater at the job site.

When cleaning pipelines between units, find a spare or jumper to return the solution to the tank. It saves laying temporary rubber hoses or piping, or cleaning by once-through procedure.

Make connections to equipment between block valves and blinds, which permits cleaning part of the process without shutting down the unit.

Install permanent chemical cleaning connections. Chemical-cleaning headers and permanently installed chemical-cleaning tanks are installed in some refineries.[3,4]

Locate the low points of all process equipment and install any additional drains required. Corrosion may occur if the cleaning solution remains in the low points.

Water-flush thoroughly following chemical cleaning. Circulate neutralizing chemical solution to kill any suspected acid residues.

**Pipe size.** High-volume delivery of cleaning solution to equipment is of prime importance, especially on product-side work. Line pressure is secondary.

A too-small pump definitely limits chance of success for in-place cleaning of the product side. Pumps with capacities of 500 to 2,500 g.p.m. at 150-ft. discharge head are used frequently.

Connecting high-volume pumps to small-diameter pipe also decreases cleaning efficiency and the chance for success, as well as lengthening circulation time.

Use 2-in. pipe for short temporary connections in the 250 to 300-g.p.m. range, 3-in. for 500 to 700-g.p.m., and 4-in. for 800 to 1,000-g.p.m. capacities. For longer lengths of temporary pipe use larger-size pipe to minimize pressure drop.

Use reflux or overhead vapor lines to carry the solution to the tower tops. These lines usually are capable of carrying high volumes with a minimum of pressure drop. Make sure these lines are not plugged before starting circulation.

Do not compromise on volume or pipe size. Use the largest of both that is justified.

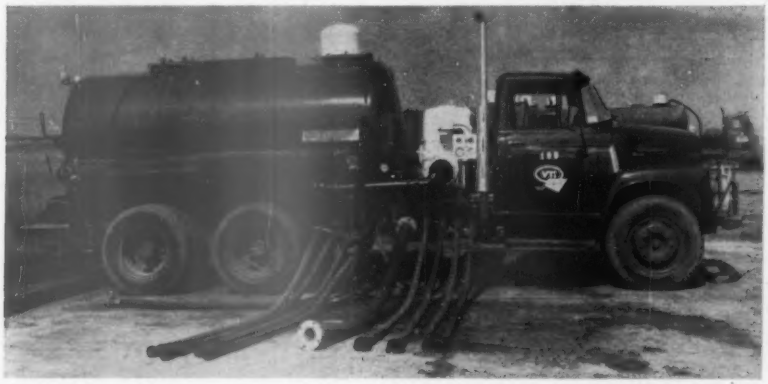
## Equipment Used

A wide variety of equipment is used for chemical cleaning. Some plants build and use their own equipment,[5] and others use the services of chemical cleaning contractors.

Some of the most common equipment includes: single-axle trucks, Fig. 6; dual-axle trucks, Fig. 7; semitrailer tank trucks with the pump mounted on the trailer; and full trailers with pump integral on the trailer or on a separate truck.

In general, contractors fabricate their chemical-cleaning equipment for the demands of a specific in-

**SINGLE AXLE TRUCK** features 1,000-gal. tank and variable-speed 80-hp. engine-driven centrifugal pump, of 1,000-g.p.m. capacity at 150-ft. discharge head, mounted on the chassis. Compartment at the tank rear stores 20-ft. lengths of 2-in. screwed chemical-solution hose, fittings, and other supplies. Four-inch flanged hose is stored on racks along the tank sides. Tank top has two 24-in. hatches for charging chemicals. An electric hoist handles debris removed from process equipment. Solution returning to tank is connected to permanent nozzle (left) so that no loose hose is ever hung over the open tank hatch lip. Gases generated during cleaning can be vented through a vent line on the tank top. Pump discharges into either one 4-in. line or a manifold for four 2-in. lines. Steam injection nozzle is on pump discharge. Titration samples are taken from a ¼-in. vent line on the pump case top. Instruments: tachometer, pump discharge pressure, engine cooling-water temperature, and chemical cleaning-solution temperature. (Photo courtesy Marine Industrial Engineers, Houston.) Fig. 6.



**DUAL-AXLE TRUCK** features all those of the single-axle truck, plus these: A pressure-vacuum motor capable of producing 26-in. Hg vacuum, or by reversing a two-way valve can pressure the tank. Also, vacuum is used to load drums of chemicals without the need for hoisting to the tank top. A submerged coil in the tank bottom is used to maintain solution temperature, which avoids steam condensate dilution of the solution. The dual-axle truck is useful for off-the-road operations in tank farms and other areas. It is used for spraying solvents and other chemicals on the exteriors and interiors of storage tanks. The time required is a matter of hours, compared to days for conventional methods. (Photo courtesy Vacuum Tanks, Inc., Houston.) Fig. 7.

dustrial area, and have built-in performance factors to meet a wide variety of job requirements.

When selecting a contractor for a chemical-cleaning job, it is important that personnel have job know-how and equipment meets the job requirements of pump capacity and solution volume.

### Safety

Disposal of hazardous gases that are generated during chemical cleaning may be a new safety problem to those who use chemical cleaning for the first time. Hydrogen sulfide, sulfur dioxide, hydrogen, and arsine gas are a few gases that can be liberated during chemical cleaning.

Hydrogen sulfide gas is very poisonous and lethal with prolonged exposure to concentrations as low as 25 to 30 p.p.m. in air. Hydrogen sulfide can be neutralized by routing vents from the solution tank through a drum of dilute caustic soda solution. In other cases, the gas volume may be enough to warrant disposal in the flare system or fuel-gas system.[6]

Gases other than hydrogen sulfide can be handled similarly.

Here are other major precautions to observe during chemical cleaning:

1. Vent equipment during chemical cleaning to prevent any liberated gas from increasing the pressure inside equipment. Install a vent line to atmosphere on top of towers being chemically cleaned. Use gas-detecting devices to monitor the concentration of liberated gases.

2. Provide gas masks and respirators when flammable and toxic gases will be liberated during chemical cleaning.

3. No flames should be permitted in the immediate area during most stages of chemical cleaning. Post signs and observe no smoking and no welding.

4. It is a must that personnel wear goggles and rubber gloves when handling acids, alkalies, and some organic solvents. Rubber hats, aprons, and suits may be necessary, also.

5. Check the piping system before starting circulation to make certain it is isolated from the rest of the unit. The circuit from the solution tank through the equipment and back to the tank must be complete with no chance for the solution going any other place.

### Disposal of Spent Solutions

Before starting the job, arrange with utilities department for proper disposal of the spent solutions. Disposal methods:

If acceptable to plant rules and regulations, first notify utilities and then dump the chemical cleaning solution into plant sewer.

Fill the tank of the chemical-cleaning truck with spent solution and truck it to evaporation ponds, burning pits, or sludge-disposal areas as directed.

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# Field control during chemical cleaning

Chemical Cleaning
Data Sheet

Equipment No. _____ Work Order _____
Service _____
Unit _____ Zone _____ Area _____
Equipment will be available _____
(hour) (date)

| Labor | | Stock Materials | | | |
|---|---|---|---|---|---|
| Craft | Manhours | No. | Code | Description | Amount |
| | | 1 | | | |
| | | 2 | | | |
| | | 3 | | | |
| | | 4 | | | |
| | | 5 | | | |
| | | 6 | | | |
| | | 7 | | | |
| | | 8 | | | |
| | | 9 | | | |
| | | 10 | | | |

| | | Direct Purchase Materials | | |
|---|---|---|---|---|
| Contractor _____ | No. | P. O. | Description | Amount |
| P. O. _____ | 11 | | | |
| Time of arrival _____ | 12 | | | |
| Gate # _____ | 13 | | | |
| | 14 | | | |
| | 15 | | | |

Deliver materials to: _____
: _____
Total chemical cleaning solution volume _____ gallons.
Cleaning Procedure
Exchanger: Tube and/or Shell side, Tower, Drums, Pipeline
(cross out nonapplicable)

Preclean: _____
(chemical) (conc.) (temp.) (hr.) (rate) (flow)
Flush: _____
(circulating rate) (hr.)
Clean: _____
(chemical) (conc.) (temp.) (hr.) (cir. rate) (dir. of flow)
Flush: _____
(circulating rate) (hr.)
Neutralize: _____
(circulating rate) (hr.)
Remarks: _____

_____ Date: _____
(Planner) (Zone Engineer) (Operations)

Piping Connections
(isometric sketch of temporary piping for the job)

Piping Details
(for welding and fabrication)

Date:
(Planner) (Zone Engineer) (Operations)

**CHEMICAL CLEANING DATA SHEET.** Send all pertinent information to the zone maintenance office for execution. Fig. 8.

AFTER the planning step is complete, the job moves to the plant for execution. Good field control is needed to realize a successful chemical-cleaning job. Field control can be divided into two phases. Its first phase is preparation of the process equipment for chemical cleaning and for returning it to service. The second phase is control of the solution during circulation.

### Preparing the Equipment

Making equipment ready for chemical cleaning is, in reality, the execution of some of the planning steps. A check list is handy to use. Here are some items:

1. Issue instructions to zone maintenance office, Fig. 8. Describe the sequence of cleaning steps and all pertinent details. Attach a sketch of the piping and include any fabrication details. Provide steam, utility water, and firewater at the job site.

2. Select a chemical-cleaning contractor based on price quotations and performance ability, if the plant does not have its own chemical-cleaning equipment. Show and discuss the job details with several contractors so intelligent quotations can be submitted. In place of multiple bids for each job, yearly contracts with one contractor can be made. Yearly contracts save time briefing the job to the contractor.

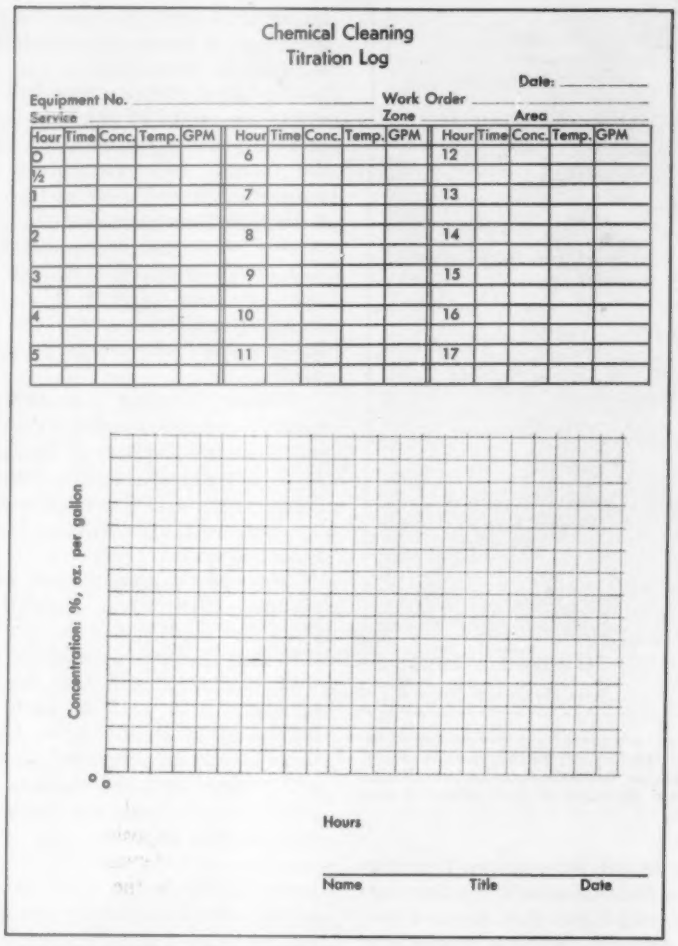
3. Confirm the exact time with the operating department that the process equipment will be offstream and ready for chemical cleaning. Schedule manpower to install blinds and temporary piping. Notify the contractor of the time to be at the unit.

4. Deliver the needed chemicals to the job site. Stock the most commonly used chemicals in the plant warehouse which saves time getting chemicals to the job site and cuts cost through purchase at quantity discounts.

5. Check safety equipment, walk the lines, and charge chemicals into the process equipment.

6. After circulation begins, check for leaks and tighten connections as necessary.

7. After completing circulation and flushing, disconnect the cleaning truck, remove temporary piping, and open equipment for visual inspection.




**RECORD PERTINENT JOB INFORMATION** for control and reference after completion. Fig. 9.

8. Return the process equipment to service.

Experience will point the way to fit the check list to the situation in each process unit.

### Solution Control

The final step of planning and executing a chemical-cleaning job is control and surveillance of the circulation rate, solution volume, temperature, and concentration.

**Circulation rate.** When the circulating pump is driven by a variable-speed drive, an indication of circulation rate is obtained by reference to the pump curve using the discharge pressure and r.p.m. For a constant-speed pump, intercept the pump curve with the discharge pressure.

**Solution level.** Check regularly the liquid level in the solution tank. The level will show if there are any blocks in the circulation system. Observe the fluid in the tank and especially behind the dam and weir to see what amount of solids accumulates there. If there are large amounts, it may be necessary to dump these from the tank one or more times before circulation is complete.

**Temperature control.** Increase solution temperature by steam injection to the recommended range. It is very important to operate in that range for maximum solution efficiency and minimum circulating time.

If the solution temperature is lower than recommended, reaction rate is slowed; and, if the temperature is above, it may be above the inhibitor's effective range.

**Titration of solution strength** shows what progress the chemical solution is making towards removing undesired scale and deposit. Titration at ½-hour intervals will show this trend.

Record titration in per cent or ounces per gallon and other pertinent data, and plot a graph, Fig. 9. In general, the first tests show maximum solution strength; later tests may indicate a straight-line decrease in strength or a decreasing rate of deposit removal with a curve resembling an asymptote.

When cleaning is complete, the solution shows no further decrease in strength. When three consecutive ½-hour readings show constant strength, cleaning usually is complete and the solution can be discarded.

In certain cases it is advisable to monitor, in addition to solution strength, other chemical properties, such as inhibitor concentration.

CHEMICAL CLEANING—PART 3

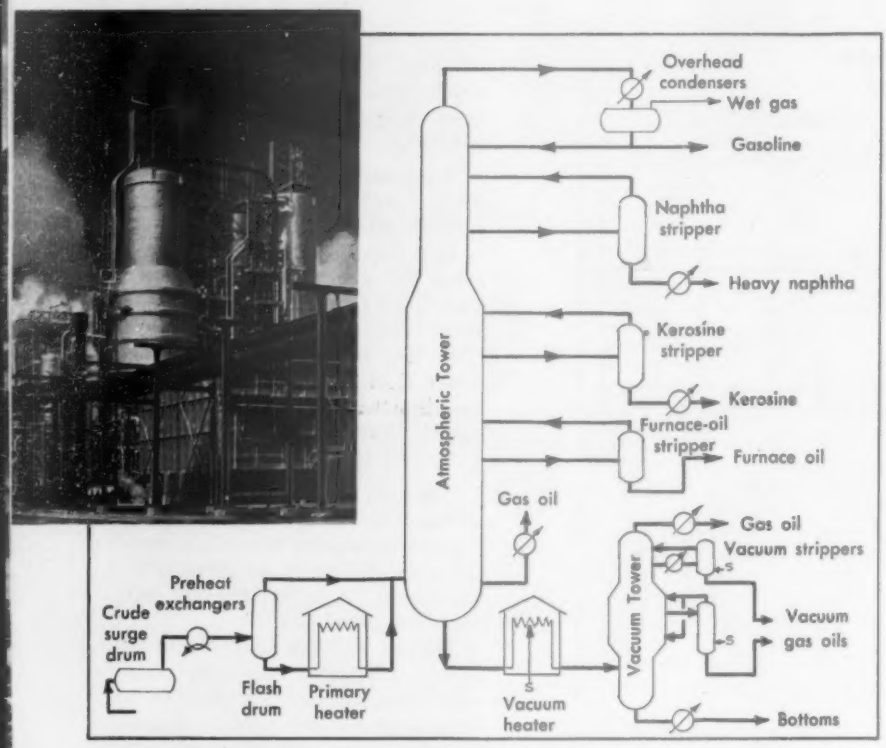
# The crude-distillation unit

SUCCESSFUL chemical cleaning of crude-distillation and similar units depends on many factors. Some of these are: type of crude, operating conditions, physical arrangement, and character of the fouling deposits.

The most attractive economics for chemical cleaning are realized from in-place circulation of chemical solutions through the equipment and most of the examples are directed there. However, some cleaning, whether by chemical or mechanical methods, can be done only when the equipment is dismantled.

The location of the equipment in the process is a valuable clue to the amount and type of deposits that may be present. See Fig. 10. Here are some typical examples of crude distillation unit cleaning.

Note: The solution concentration and circulation time and rate shown in the discussion are based on those required for cleaning one piece of




**CLEANING CRUDE UNITS.** Crude distillation units encounter operating temperatures from ambient to near 1,000° F. Chemical cleaning of the higher-operating-temperature parts has limited application because of coke-forming conditions there. Where coke is not formed readily, chemical cleaning is very effective and reduces cost and down time. Fig. 10.

equipment, unless discussed otherwise in the case histories.

**Crude-surge drum** is usually the first process equipment the crude oil enters. These drums can be partially chemically cleaned of light and heavy oil deposits, but manual methods are needed to remove heavy deposits of tar and asphalt.

**Crude-oil preheat exchangers** of the shell-and-tube type can be cleaned by four methods, depending on job conditions:

1. In-place cleaning is done if the tube bundle is square-pitched design and all tube planes are open. A procedure often effective is to circulate a heavy-duty alkaline solution in combination with a solvent emulsion at 190° to 200° F. for 6 to 8 hours, at 500 to 800 g.p.m., from the shell bottom to top.

Reverse circulation during the last hour of circulation may help remove heavy small particles, if suspected. Flush first from the shell bottom to top and then reverse. The same cleaning procedure can be used on the tube side.

Remember that in-place circulation will not open plugged tubes. Also, heavy static solids that are too large to pass between the tube supports and tubes will remain. Further, exchangers that process sour crude will need acid-descaling treatment to remove iron sulfide deposits after alkaline cleaning.

2. High-pressure jet rinsing for 1 to 4 hours is used after in-place circulation for final deposit removal from exchangers processing crudes with higher tar and asphaltic content. The bundle is pulled for rinsing.

3. Hot-tank immersion cleaning is used for bundles fouled more completely. This procedure has been used:

(a) Immerse the bundle in a solvent emulsion cleaner that is diluted with 3 to 4 parts of mineral solvents (kerosine or diesel fuel) at 90° to 100° F. for 1 to 4 hours.

(b) Transfer directly without rinsing into an agitated heavy-duty alkaline cleaning solution at 190° to 200° F. for 3 to 4 hours.

(c) Remove from the alkaline solution and water rinse.

(d) Immerse in an acidic solution to remove iron sulfide scale on the tube surfaces.

(e) A high-pressure jet rinse may be required for final deposit removal or in some cases sandblasting may be necessary.

4. Manual cleaning may be necessary on either or both the shell and tube side of the bundles. When the interior tube surfaces are plugged, manual drilling is the method for removing deposits. The method to remove hard, unresponsive shell-side deposits of high asphalt or coke content is manual chipping and sawing away deposits between the tubes using hacksaw blades.

**Primary heater** generally has flintlike coke and carbon deposits on the interior surfaces of the tubes. It is not yet possible to remove them chemically. Removal is done by pneumatic or mechanically operated drills.

**Atmospheric fractionation tower** cleaning efficiency is dictated by the tower's physical and chemical condition. Towers operated too long without cleaning will have deposits of coke, ⅛ in. to 2 ft. thick, adhering tightly to the walls. Under these conditions, chemical cleaning will remove only oil residues, but mechanical methods are needed to remove coke deposits.

When coke deposits are not adhering tightly to the walls, the following chemical cleaning procedure can be used.

1. Remove oil and wax residue deposits by circulating a heavy-duty alkaline cleaning solution plus 5 vol. % of solvent emulsion at 180° to 200° F. for 6 to 8 hours at the rate of 800 to 1,000 g.p.m. from the tower top. Only bubble caps, chimneys, trays, and downcomers will be cleaned. Complete interior cleaning requires filling the tower and circulating from the bottom to top.

2. Flush with water for 2 hours.

3. Remove iron sulfide and oxides by circulating an acidic solution from tower top at 120° to 200° F. (temperature depends on the acid and inhibitor) for 4 to 6 hours at 500 to 800 g.p.m.

4. Flush with water for 2 hours.

5. Neutralize any trapped acid residues by circulating a 3 to 4-oz. per gal. solution of soda ash at ambient temperature from tower top.

6. Circulate a 2 to 4-oz. per gal. solution of amine nitrite, warm or cold, pH above 8, to prevent rusting while the tower is out of service

for inspection and repair. The treatment prevents rust from forming for periods of 6 weeks to 2 months.

Towers in good condition without much oil or wax residue deposits can be cleaned and descaled as follows:

1. Remove oil and wax residue deposits and corrosion products by circulating a solution of 12 to 16-oz. per gal. of acidic salts, inhibitors, and wetting agents plus 5 vol. % of solvent emulsion at 180° to 200° F. for 6 to 12 hours at 800 to 1,000 g.p.m., from the tower top.

2. Flush with water for 2 hours.

**Gas-oil coolers** can receive good chemical cleaning on the shell side when tubes are square pitched and good flow can be obtained around the tube exteriors. This procedure has been successful.

1. Circulate a solution of 12 to 16-oz. per gal. of heavy-duty alkaline cleaning compound plus 2 to 5 vol. % of solvent emulsion at 180° to 200° for 4 to 5 hours, at the rate of 500 to 800 g.p.m., from the bottom of the shell.

2. Flush with water from the bottom for 1 hour.

3. Remove scale deposits from metal surfaces and any remaining gas-oil deposits by circulating a 12 to 16-oz. per gal. solution of combination cleaning-descaling compound (dry acid salts, oxalic acid, detergents, and inhibitors), plus 2% by volume of solvent emulsion at 180° to 200° F. for 3 to 4 hours, at the rate of 500 to 800 g.p.m., from the shell bottom.

4. Flush with water from the bottom for 1 hour.

**Kerosine and naphtha coolers** can be cleaned and descaled as follows:

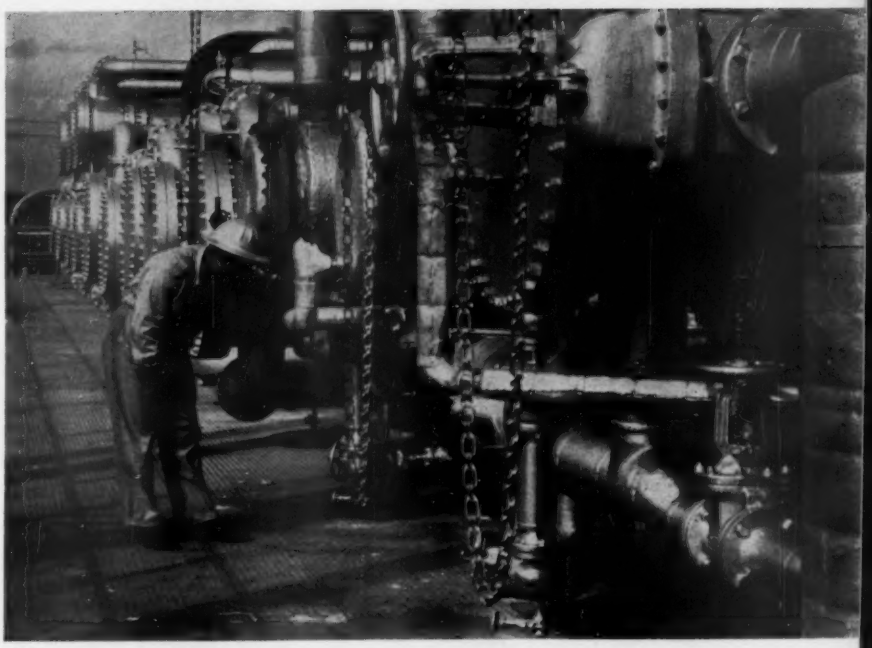
1. Circulate a solution of 12 to 16-oz. per gal. of combination cleaning-descaling compound (dry acid salts, oxaltic acid, detergents, and inhibitors), plus 5 vol. % of solvent emulsion, at 180° to 200° F. for 5 to 6 hours at the rate of 500 to 800 g.p.m., from the shell bottom.

2. Flush with water for 1 hour.

**Atmospheric tower overhead condensers** have deposits from stream and gasoline vapors which may be removed as follows:

1. Circulate a 12 to 16-oz. per gal. solution of a combination cleaning-descaling compound (dry acid salts, oxaltic acid, detergents, and inhibitors), plus 2 vol. % of muriatic acid, plus 2 vol. % of solvent emulsion at 180° to 200° F. for 4 to 6 hours at 800 g.p.m., from the bottom of the shell.

2. Flush with water for 1 hour.



**INTERMEDIATE REFLUX COOLERS** usually need dual cleaning as follows: (1) Remove organic deposits by circulating an 8 to 12-oz. per gal. solution of heavy-duty alkaline cleaning compound, plus 2 to 5 vol. % of solvent emulsion at 180° to 200° F., for 4 to 6 hours at 600 to 800 g.p.m. from the bottom of the shell. (2) Flush water for 1 hour. (3) Remove iron sulfide or other metallic scale deposits by circulating a 12 to 16-oz. per gal. solution of combination cleaning-descaling compound (dry acid salts, oxalic acid, detergents, and inhibitors) at 180° to 200° F. for about 4 hours at 500 to 800 g.p.m., from the bottom of the shell. (4) Flush with water for 1 hour. Fig. 11.

**Intermediate reflux cooler** cleaning is shown in Fig. 11.

**Furnace oil, kerosine, and Naphtha-stripper towers** are cleaned and descaled as follows:

1. Circulate a 12 to 16-oz. per gal. solution of acidic salts, inhibitors, and wetting agents, plus 5 vol. % of solvent emulsion, at 180° to 200° F. for 6 to 12 hours at 800 to 1,000 g.p.m., from the top of the tower.

2. Flush with water for 2 hours.

**Vacuum-tower heater** has deposits similar to those found in the primary heater. The hard, flintlike coke deposits on the tube interiors are removed by mechanical methods because it is not yet possible to remove them chemically.

**Vacuum towers** rarely are chemically cleaned with high efficiency because of the nature of the heavy-crude-oil-bottoms feed and high operating temperatures. No chemical solvents are available to dissolve coke deposits that are 1 ft. to 3 ft. thick in these tower bottoms.

However, chemical cleaning of interior vacuum tower surfaces can remove organic oil deposits and help make final manual cleaning much easier and safer, as follows:

1. Clean oil residues from trays, bubble caps, and downcomers by circulating from the tower top an 8-oz. per gal. solution of heavy-duty alkaline cleaner, plus 5 vol. % of solvent emulsion at 180° to 200° F. for 12 to 18 hours at 800 to 1,000 g.p.m. Follow the cleaning with a thorough water flush for 2 to 4 hours.

2. Clean the entire interior surfaces of the tower, if desired, by filling and circulating the same chemical solution from the bottom of the tower. Before filling the tower with solution, determine whether the foundation will carry the added weight of the cleaning solution.

**Vacuum - stripper towers** process stocks of vacuum gas oils and residues and usually require heavy-duty cleaning, followed by acid treatment to remove organics and scales, re-

spectively. The chemical materials, methods, and final cleaning efficiency depend largely on whether the equipment is lightly or heavily fouled An extreme case may require the following:

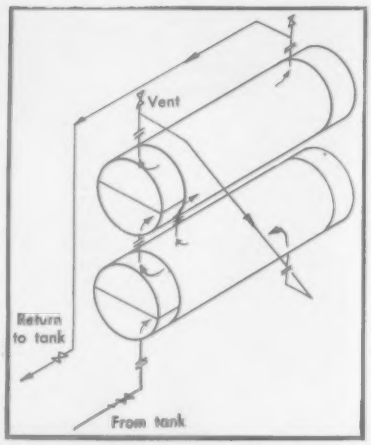
1. Remove organic residue deposits by circulating an 8 to 12-oz. per gal. solution of heavy-duty alkaline cleaning compound, plus 2 to 5 vol. % of solvent emulsion at 180° to 200° F., for 6 to 12 hours, depending upon the tower size, at the rate of 800 to 1,000 g.p.m., from the tower top.
2. Flush with water for 1 to 2 hours.
3. Circulate from the top an acidic solution for 3 to 5 hours at 500 to 800 g.p.m.
4. Flush for 1 to 2 hours.
5. Neutralize any trapped residues by circulating a 2 to 4-oz. per gal. solution of soda ash for 2 to 3 hours.
6. An inspection may find that hard cokelike deposits are adhering tightly to the metal. Chipping or blasting is required to remove them. Vacuum clean or rinse off with water jet any loose, cokelike chips found between the bubble caps.

**Vacuum-gas-oil exchangers** can be cleaned of oil residues on both shell-and-tube side simultaneously. Check these items before starting to clean these exchangers:

1. Are the tubes open? Chemical cleaning will not open plugged tubes, and drilling is usually required.
2. Are carbon deposits adhering tightly to the outside of the tubes? Removal of these deposits when they are extensive can be done by mechanical sawing, high-pressure jet rinsing, or sandblasting.

If the answers to these questions are yes and no respectively, use the following:

1. Circulate a 12-oz. per gal. solution of heavy-duty alkaline cleaning compound plus 2 to 5 vol. % of solvent emulsion at 180° to 200° F. for 4 to 6 hours at 600 to 800 g.p.m. The piping is shown in Fig. 12.
2. Reverse circulation for the last hour to sweep out any deposits in the shell bottom. Steps 1 and 2 will remove oil-and-wax residue deposits.
3. If metallic oxides and iron sulfides are deposited directly on the metal surfaces, a second cleaning step is necessary. Circulate a solution of dry acid salts, plus 10 vol. % of inhibited muriatic acid at 120° to 160° F. (temperature depends on the inhibitor's heat range) for 3 to 4 hours at 600 to 800 g.p.m. When large amounts of iron sulfide are suspected, add 2 vol. % of solvent emulsion to control hydrogen sulfide release to the plant atmosphere.
4. Flush with water for 1 hour from the bottom.
5. Neutralize any trapped acid residues by circulating a 2 to 4-oz. per gal. of soda ash, warm or cold, for 1 hour.




**PIPE CONNECTIONS** to clean two heat exchangers simultaneously on both the two-pass tube side and one-pass shell side. Circulate from the bottom and enter the tubes first. Fig. 12.

**Vacuum-tower-bottoms exchangers** are cleaned by pulling the bundles and immersing them in hot solvents at temperatures below the solvent's flash point, followed by high-pressure jet blasting and mechanically sawing the deposits free from the outside of the tubes. It is often not possible to obtain good cleaning by circulating chemical solutions because of the feed's high solids content and the fact that high operating temperatures help promote carbon deposition.

Vacuum tower use is not limited to crude distillation. They are used extensively to prepare feed for lube-oil and catalytic cracking units.

Here are some examples of chemical cleaning as applied to a vacuum unit in lube-oil preparation service. The flow diagram is similar to the vacuum tower shown in Fig. 10. The exchangers are presented in order from the lowest to highest operating temperatures.

**Cylinder-stock exchangers** can be cleaned of oil residues on both the tube and shell side simultaneously, using the same method outlined for vacuum-gas-oil exchangers.

**Wax-distillate exchangers** handle liquid oil wax distillate stocks. Cleaning procedure is similar to that outlined for vacuum-gas-oil exchangers.

**Asphalt exchangers** handle the bottoms product of vacuum towers. Experience shows that the conditions are similar to vacuum-tower-bottoms exchangers, and that chemical cleaning is not always possible.

Maximum use of chemical cleaning during crude unit turnarounds will shorten down time, use manpower more efficiently, and reduce costs. Less mechanical handling is needed with chemical cleaning, which saves wear and tear on equipment.

The crude unit has many sizes of process equipment located at various positions on the unit. Use existing piping to the maximum possible to avoid excessive temporary pipe and hoses.

Chemical cleaning removes deposits clear down to the base metal surfaces which increases throughput, heat transfer, and lengthens time between cleanings because deposit forming nuclei are removed.

CHEMICAL CLEANING—PART 4

# Fluid catalytic crackers

THE CATALYTIC cracking process, whether fluid or moving bed, produces excellent yields of high-octane gasoline from many feed stocks.

The flow diagram, Fig. 13, illustrates the location of process equipment.

**Feed preheaters.** Gas-oil feed enters at 100° to 150° F. and is heated to 600° to 700° F. before

injection into the hot catalyst transfer line to the reactor.

Chemical cleaning is not efficient in removing the coke and carbon deposits in the tubes. Pneumatic or mechanically driven drills usually are used to remove these deposits.

**Reactors and regenerators.** The large physical size of equipment and high circulation rate that would be necessary preclude extensive use of chemical cleaning.

Cleaning materials (dry acid salts, oxalic acid, detergents, and inhibitors) are available that remove oxides and gummy deposits without attacking the firebrick and plastic refractory insulations.

**Fractionator towers.** Efficiency of chemical cleaning depends upon the type and amount of scales and deposits present. Deposits become carbonized more highly the longer the tower is operated without cleaning.

If fouling is too severe, chemical cleaning will remove only oily residues, and mechanical methods are required to remove the coke. Obtain samples and analyze them before doing any chemical cleaning on these towers.

When the towers have been operated too long without cleaning, the following procedure has proved successful:

1. Circulate an 8 to 16-oz. per gal. solution of combination cleaning-descaling compound (dry acid salts, oxalic acid, detergents, and inhibitors) plus 2 vol. % of solvent emulsion at 190° to 200° F. for 8 to 18 hours at 800 to 1,000 g.p.m. from the top of the tower.
2. Gravity-drain tower and flush with water for 1 hour.
3. An inspection of the tower may find chemically inert coke chips lodged between the bubble caps. Remove the coke chips with a jet of high-pressure water.

**Fractionator Overhead Condensers.** Here is an actual case history of cleaning and descaling eight condensers on both the tube and shell sides.

The tubes have cooling water and the shell has gasoline. The tubes are admiralty metal; and shell, tube sheets, and tube supports are steel.

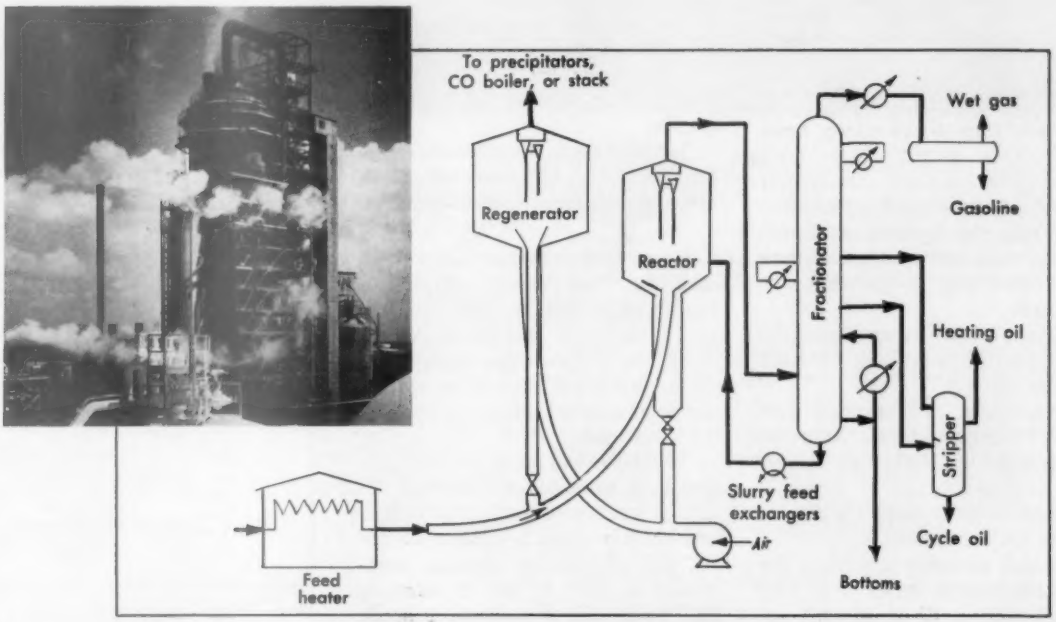
Two methods have been used, but both are unsatisfactory:

1. Pull bundles and drill tubes. Use a saw blade between the tube exteriors to remove shell-side deposits and then wet-sandblast. High crane time and 4 days' work was required on each bundle.
2. Circulate inhibited muriatic acid through both shell and tube sides. The bundles were not cleaned, hydrogen sulfide was released to plant atmosphere, and the acid corroded bare spots on the admiralty tubes.

The new chemical-cleaning method began with sampling and analyzing the deposit. Tube-side deposits contain hard-water-lime scale, complicated by silicates and light oil films. Shell-side deposits are composed of iron sulfide, iron oxide, and light-carbon-content organics.

Tube-side cleaning procedure for two condensers in series (Fig. 14):

1. Remove oil deposits by circulating a solution of 8-oz. per gal. of alkaline cleaning compound at 190° to 200° F. for 4 hours at 800 g.p.m., from the shell bottoms. Gravity-drain the solution and transfer to the next two condensers.
2. Flush both condensers in series with firewater for ½ hour.
3. Circulate a 15 vol. % solution of inhibited muriatic acid (dilute from 20° B.), plus 1 oz. per gal. of ammonium bifluoride, at

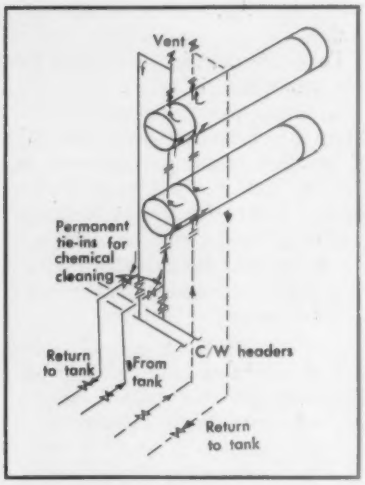



**CATALYTIC CRACKING UNITS** may be chemically cleaned with good efficiency when amount of coke in the deposit does not prevent chemical reaction. Generally, parts with higher operating temperatures contain deposits of high coke content. Lower-temperature parts may be cleaned with any of several chemicals, but this depends on the amount of organics vs. inorganics present. Fig. 13.

110° F. for 4 hours at 500 g.p.m., from the shell bottom.

Ammonium bifluoride gives temporary conversion to weak hydrofluoric acid in the muriatic acid medium and attacks the silicate deposits. The muriatic acid can then react with hard-water-lime scale.

Titrate every ½ hour to find effective acid concentration and the time descaling is complete, Fig. 15. Exposure of admiralty metal to free chlorides causes the metal to generate antimonial oxide, which on overexposure to the acid will dissolve, and admiralty metal thus is




**TWO FRACTIONATOR** overhead condensers being chemically cleaned in series. Tube side—two pass. Shell side—two pass. The solid lines show piping for the tube side. Dashed lines for shell side. Flow from the bottom on both tube and shell sides keeps the low points from becoming traps. Fig. 14.

attacked. After descaling is complete, drain the muriatic acid into a holding tank and readjust strength before circulating to the next two condensers.

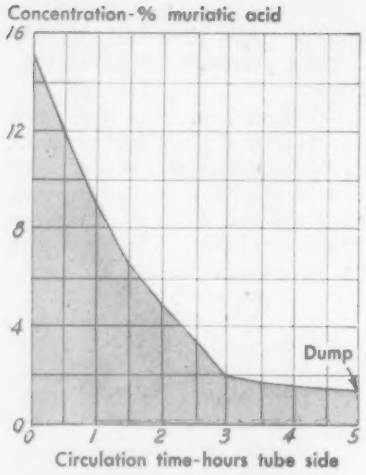
4. Flush with water from the bottom for ½ hour, and ½ hour from the top.

5. Neutralize any trapped acid residue by circulating a solution of 2-oz. per gal. of soda ash for ½ hour.

6. Repeat these steps on the remaining six condensers.

Shell-side cleaning procedure for two condensers in series (Fig. 14):

1. Circulate a 12-oz. per gal. solution of powdered combination cleaning-descaling compound (dry acid salts, oxalic acid, detergents, and inhibitors), plus 2 vol. % of




**TITRATION CURVE** showing per cent of muriatic acid concentration at ½ hr. intervals. Note that the last three titrations have the same concentration. This means that scale removal is complete. Fig. 15.

solvent emulsion, at 190° to 200° F. for six hours at 900 g.p.m., from the shell bottom.

Drain the solution and transfer it to the next two condensers. Adjust effective concentration back to 12 ounces per gal.

2. Flush with water for ½ hour from the bottom and then reverse for ½ hour.

Results of the new chemical cleaning method:

1. Both shell side and tube side are cleaned, with no metal attack.

2. The need for a crane is eliminated. Saving on one job was about $8,500.

3. After 48 hours of service, the heat-exchanger efficiency was 54% above the efficiency before cleaning.

**Slurry feed exchangers.** Here is a case history of cleaning and descaling six exchangers on both the shell and tube sides. Hot oil is on the shell side, and the tubes carry slurry oil and catalyst fines. The 42-in.-diameter all-steel exchanger has 892 1-in. o.d. tubes 16 ft. long.

Two historical methods were used and both were unsatisfactory:

1. Circulate through the tubes and shell in series a solution of 16-oz. per gal alkaline cleaning compound at 200° F. for 15 hours at 300 g.p.m. Oil deposits were partly removed, but scale deposits remained on tube surfaces. This made the equipment unserviceable.

2. Circulate a 20 vol. % solution of inhibited muriatic acid (diluted from 20° B.) at 120° F. for 12 hours at 300 g.p.m. Much oil and scale remained on tube surfaces; cleaning was unsatisfactory.

A new cleaning procedure was found that would remove simultaneously from the tube side the slurry oil, wax, and catalyst fines, and from the shell side the oil, iron oxide, and iron sulfide. Two exchangers are cleaned simultaneously (Fig. 16):

1. Circulate a solution of 16-oz. per gal. combination cleaning-descaling compound (dry acid salts, oxalic acid, detergents, and inhibitors), plus 5% by volume of emulsion solvent at 190° to 200° F. for 6 hours at 800 g.p.m.

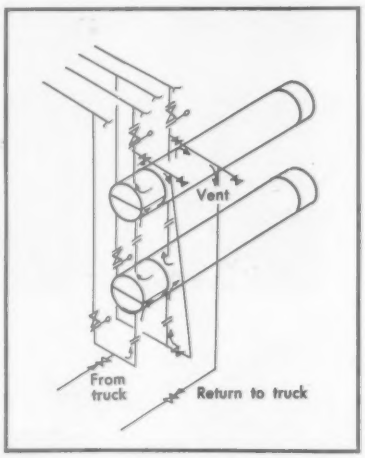
2. Drain solution to plant sewer system.

3. Flush with water for ½ hour from the bottom, and ½ hour from the top.

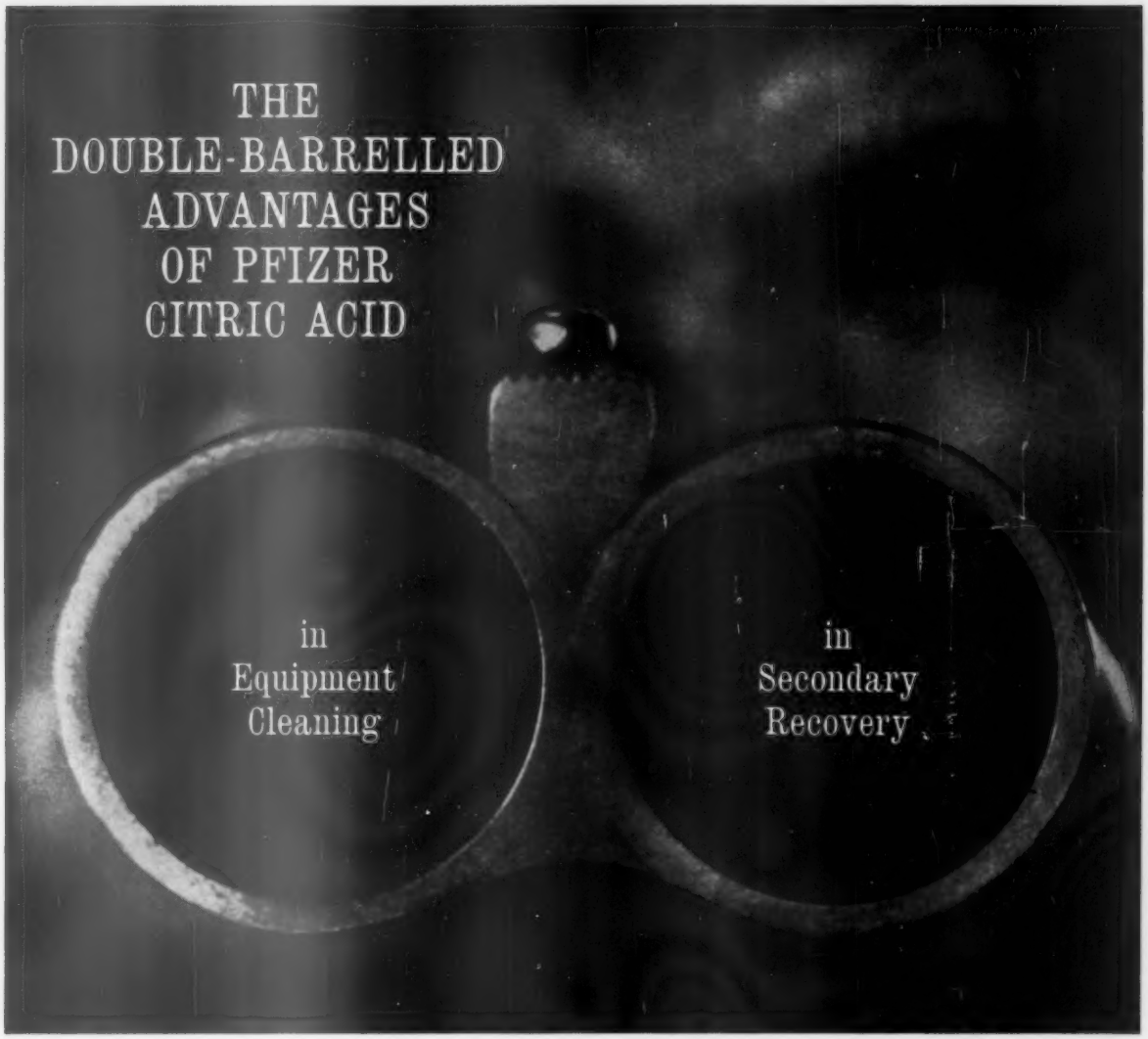
4. Return the first two exchangers to service, and repeat cleaning procedure on the remaining four in turn.

Results of the new method: Both shell and tube sides were clean and no metal attack had occurred. Heat-transfer efficiency was raised to over twice that before cleaning.

Isolate the equipment from the rest of the unit to avoid loss of solution into the process. Make permanent chemical-cleaning tie-ins to shorten job time. Cleaning efficiency helps raise unit efficiency and throughput.




**TWO SLURRY FEED EXCHANGERS** with two-pass tubes and two-pass shells are cleaned simultaneously in series. Both tube and shell sides are cleaned from the bottom. Existing piping is used where possible. Venting during filling prevents air pockets, Fig. 16.

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# The refinery gas plant

GAS PLANTS recover and separate light ends from many refinery units, Fig. 17.

Efficient operation is vital to over-all refinery economics.

Iron sulfide deposits in this equipment occur from sulfur-bearing gases generated in other units. When this equipment is operated too long, chemical cleaning is more difficult because of iron sulfide deposits complicated by heavy tarlike organic residues.

**Fractionator, adsorber, debutanizer, and depropanizer towers** are chemically cleaned successfully, provided they are not operated until coke percentage is too high and binder percentage too low for the deposit to respond to chemical cleaning.

Following procedure has proved successful for these conditions:

1. Circulate an 8 to 16-oz. per gal. solution of combination cleaning-descaling compound (dry acid salts, oxalic acid, detergents, and inhibitors), plus 2 to 5 vol. % of solvent emulsion at 190° to 200° F. for 8 to 18 hours, at the rate of 800 to 1,000 g.p.m., from the tower top.
2. Gravity-drain and flush with water for 1 to 2 hours.
3. An inspection of the tower may reveal coke chips lodged between the bubble caps. Remove them by vacuum cleaning each tray or rinsing off with a high-pressure water jet.

**Overhead condensers** have deposits very similar to those found in crude-distillation-atmospheric-tower overhead condensers. Sample the deposit and analyze it before starting any chemical cleaning of these condensers. Different units may process similar stocks, but the deposits may vary significantly because of different operating conditions and slight composition differences.

**Debutanizer tower and reboiler** are cleaned simultaneously to save time and show the simplicity of chemically cleaning several pieces of equipment in series. The all-steel tower is 5 ft. in diameter, 95 ft. high, and has 44 bubble-cap trays. The reboiler is vertical and except for admiralty tubes is all steel. Historically, the tower and reboiler were cleaned in separate operations.

1. Reboiler cleaning began by using a large crane to remove the bundle from the shell and take it to the salvage yard. It was cleaned by a 4 to 6-hour soak in an acid bath, water rinse, and drilling the tubes. Total time was 4 days.
2. Tower cleaning began by removing all the bubble caps and sandblasting them. Trays were sandblasted in place. Total time was 5 to 6 days.

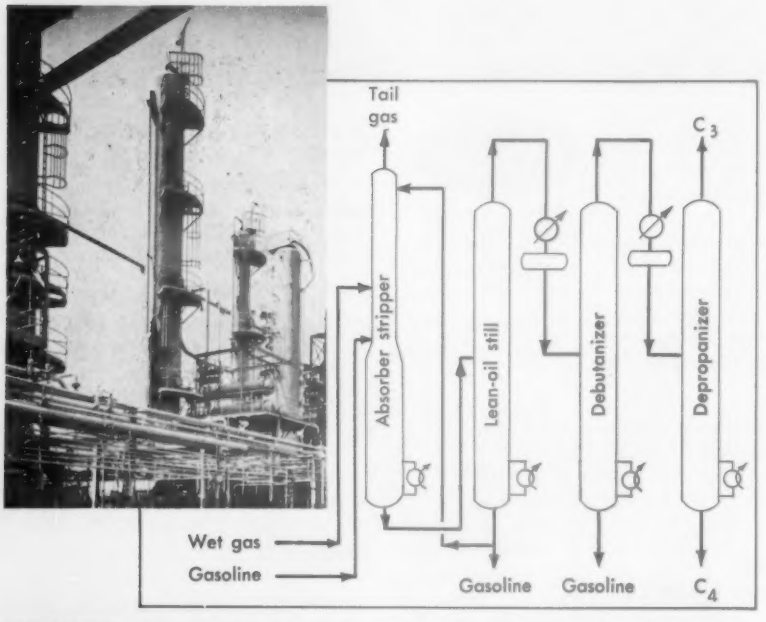
Analysis of the deposits showed the tower and reboiler had similar deposits of iron oxide, iron sulfide, carbon in small percentages, and resin deposits.

New cleaning procedure.

1. Circulate a 12-oz. per gal. solution of combination cleaning-descaling compound (dry acid salts, oxalic acid, detergents, and inhibitors) plus 2 vol. % of solvent emulsion at 190° to 200° F. for 13 hours at 900 g.p.m. Design the circulation system to prevent the reboiler from becoming a trap for debris removed from the tower.
2. Gravity drain the solution to the plant sewer.
3. Flush with water for 2 hours.

Results of the new method:

1. Both tower and reboiler freed of deposits and scale.
2. Saved 5 days' downtime and lowered costs to 40% of former manual methods.




**LIGHT ENDS** processed in these units are not immune from forming deposits. Careful sampling and analysis avoid the pitfall of underrating their possible complexity. The nature of the process and deposits permits cleaning several pieces of equipment with the same solution. Fig. 17.

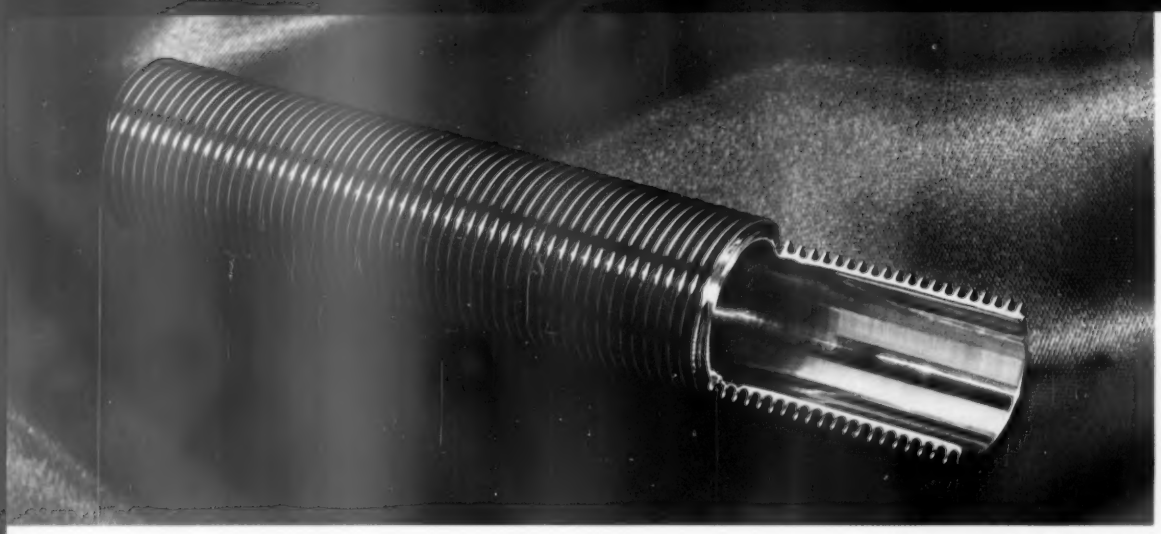
### Conclusions

Sample gathering and analysis are the keys to selecting the correct chemical-cleaning solution. Circulate chemical-cleaning solutions first through the tubes and then through the shell. Introduce the solution from the bottom of both which avoids either from becoming a trap for removing debris.

Remember that chemical cleaning is unable to free plugged tubes; neither will it dissolve coke or carbon. Small clearances between the tubes may preclude efficient flushing out of deposit debris.

This article has shown how to plan and execute an in-place chemical-cleaning job and then how these principles were used to clean some major refinery units.

Upon successful completion of a chemical-cleaning job, the complete cleaning procedure should be entered for future reference in the plant's records.



*Wolverine Trufin Type S/T*

# This is Wolverine Trufin® Type S/T

Designed expressly for use in shell and tube heat exchangers, this low-finned tube has an outside to inside surface ratio of approximately 3.75 to 1. The outside diameter of the finned section is equal to the diameter of the plain ends for easy installation and replacement.

Trufin Type S/T is available in a wide range of alloys and sizes in copper, aluminum and steel and in standard fin spacings of 16 or 19 fins per inch. It can be ordered in straight length or U-bend form. It can also be readily fabricated into coils, bends, etc.

Trufin Type S/T is ideal for tube replacement in shell and tube heat exchangers or in the design of new units. In the former it can increase capacity by as much as 150 per cent. In the latter it permits a more compact unit to carry a heat load equal to a much larger unit utilizing plain tube.

This oustanding low-finned tube is also available as Trufin Type S/T Duplex—an integrally finned outer tube mechanically bonded to a conventional inner tube of any desired metal or alloy. Thus, in one tube, the user has a product with the ability to both increase heat transfer performance and withstand specific corrosive conditions.

Write for more information . . . or Ask Your Wolverine Tube Salesman—HE KNOWS.

*Wolverine Trufin Type S/T Duplex*

**WOLVERINE TUBE**
DIVISION OF
**Calumet & Hecla, Inc.**
DEPT. M, 17238 SOUTHFIELD RD., ALLEN PARK, MICH.

*TUBEMANSHIP in Copper—Copper Alloys—Aluminum—Special Metals*

PLANTS IN DETROIT, MICHIGAN AND DECATUR, ALABAMA
SALES OFFICES IN PRINCIPAL CITIES

# SEE FOR YOURSELF

Take a look at the comparison chart on this page. Selected at random from Wolverine Tube's case history file, it presents dramatic proof of how integrally finned Wolverine Trufin Type S/T increases heat duty—*without increasing unit size.* In this application—the condensing of thermo-cracked straight-run gasoline from a re-run tower—capacity jumped *38%*. Also, when tubed with prime surface tube, the unit was pulled off stream every 90 days for cleaning. After tubing with Trufin Type, S/T, the tube bundle required cleaning only every eight months.

Next time you are considering revamping or retubing heat exchangers or condensers—get the Wolverine Trufin story first—see for yourself how this modern tube can help you do a better job. Write for complete information or Ask Your Wolverine Tube Salesman—He Knows.

**THE SITE:** A gulf coast refinery

**THE WORK:** Condensing thermo-cracked straight run gasoline from a re-run tower

**THE UNIT:** A pressure distillate overhead condenser

| | PRIME SURFACE TUBE | TRUFIN—TYPE S/T |
|---|---|---|
| No. of tubes | 500 | 500 |
| Outside surface, Sq. Ft. | 1522 | 3280 |
| Metal | 16 BWG Admiralty | 16 BWG Admiralty |
| Tube size | ¾" O.D. | ¾" O.D. |
| Shell Side, Flow, Lbs./Hr. | 19780 | 27350 |
| —Temperature in | 261° F. | 261° F. |
| —Temperature out | 125° F. | 101° F. |
| Heat Load, BTU/Hr. | 3,960,000 | 5,820,000 |

**WOLVERINE TUBE**
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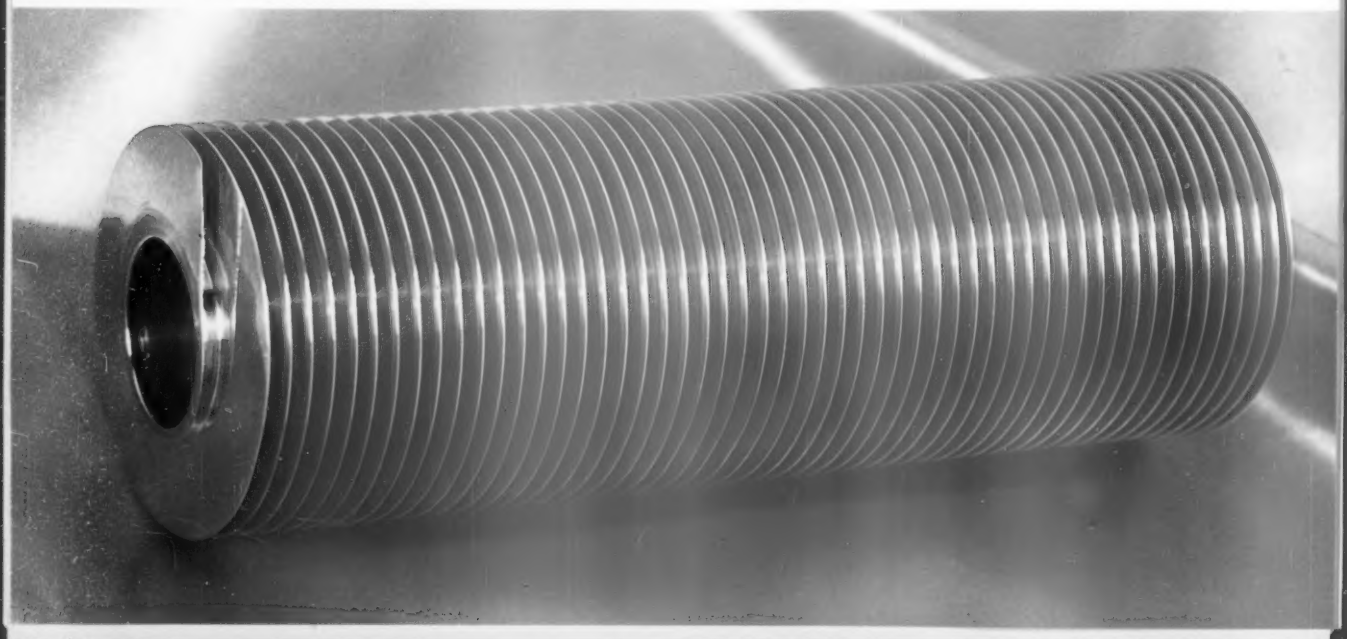
## WOLVERINE TRUFIN TYPE L/C BIMETAL

And, for those applications where air cooling is advantageous, Wolverine Tube recommends Wolverine Trufin Type L/C. With its high-finned outer tube of aluminum mechanically bonded to a liner of any desired metal or alloy, Type L/C is ideal for use where water shortages or brackish or corrosive waters make liquid cooling impractical. It is finding wide use in refineries, gas plants, pipe line compressor stations, chemical plants, petro chemical plants and transformer oil coolers, etc.



HOW TO REDUCE DRILLING COSTS: PART II

# How pipe and hole size affect drilling hydraulics

BY PRESTON L. MOORE
University of Oklahoma

IN PREVIOUS installments of this series, we hope you have seen how important hydraulics are in determining drilling cost. If you do realize the full extent of hydraulic's role, you will be certain to keep it in mind when you decide on hole sizes and pipe sizes.

More and more frequently, we find poorly chosen pipe and hole sizes as the basic reason for poor hydraulics and higher-than-necessary drilling cost.

First, let's look at pipe sizes. We know friction losses go up as pipe bore gets smaller. So, it is obvious that under most conditions smaller pipe means poorer bottom-hole hydraulics. Let us, for example, take a case using bit horsepower as the criterion for our design. Our calculations will show that whether surface pressure is limited or not, efficiency of the hydraulics program goes up as drill-pipe size increases. If our surface pressure is limited, the same thing is also true for hydraulic impact.

However, when surface pressure is not limited within the range of design, we can select a circulation rate which results in about the same bottom-hole impact regardless of pipe size. Here is an example to show this. Assume we are to drill a 10,000-ft. hole with an 8¾-in. bit. Our 650 ft. of drill collars are 6¾-in. o.d. by 2¾-in. i.d. There is no limit on our surface pressure and we have 500 h.hp. at the surface. Mud weight is 10 lb. per gal.

Fig. 1 plots these conditions. Locate the points where the 0.25 (500-hp.) curve intersects the pressure-loss curve for the circulating system using both 4½ and 5-in. drill pipe. These points represent the optimum rates of circulation. Remember that in earlier installments we showed 75% of the pump pressure should be expended across the bit for optimum. Thus the 0.25 curve (or 25% line) is the portion of the pressure remaining to be expended in other parts of the circulating system.

From these curves, optimum rate of circulation with 4½-in. pipe is 330 g.p.m. For 5-in. drill pipe, it is 355 g.p.m. Hydraulic impact is about the same in both situations.

Surface pressure with the 4½-in. pipe is 2,630 psi. With 5-in. pipe, it is 2,420 psi. This difference of 210 psi. is less than 10% of the total. However, as pipe becomes smaller, much more surface pressure is required to maintain comparable hydraulics.

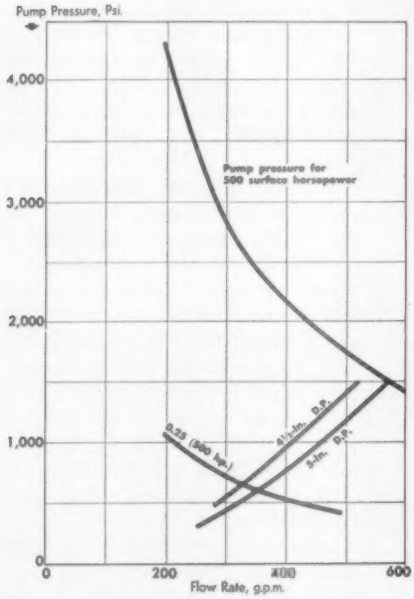
**In small hole sizes.** The problem of small pipe sizes introduces a new problem: designing a hydraulics program for slim-hole drilling. The biggest saving in drilling a small-diameter hole has been using less steel; in some cases, rig cost has been less.

Very often, however, operators and contractors have found themselves taking longer to drill smaller hole sizes. Such slower drilling may partially offset any saving and forces us to make changes.

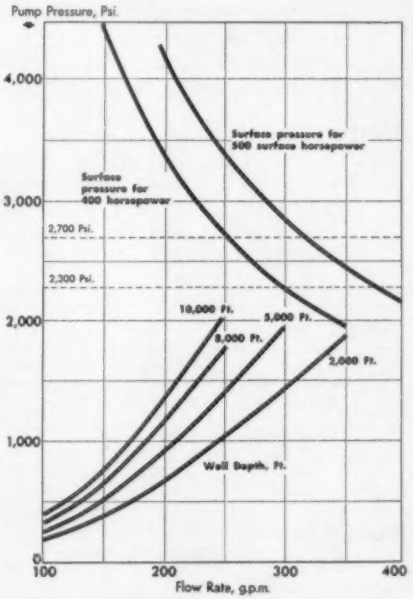
It has always been popular to say that for small-diameter holes we need a "slim-hole rig." This sounds appealing. But, it doesn't explain: What is a slim-hole rig?

Here, we are concerned only with hydraulics. So, we will not try to set out a complete description of such a rig. We will discuss one important requirement of a good slim-hole rig—a properly sized pump. The pump must be one which can furnish the horsepower in a good balance between pressure and volume. From what we've already said, it is obvious we will need higher pressures and smaller volumes.

To illustrate the point, let us take another example. This time, assume that a 6½-in.




**WITH NO LIMIT** on pressure on the pump, optimum circulation rates for the example well are 330 g.p.m. for 4½-in. pipe and 355 g.p.m. for 5-in. pipe. The 0.25 curve shows that 75% of 500 hp. at surface is being expended at the bit. Fig. 1.




**WITH A LIMIT** on pressure on the pump liners, hydraulics are poor since not all of surface pump horsepower can be used. For the rig and well in the example, a 400-hp. power pump is just as effective as a 500-hp. pump when drilling below 5,000 ft. Fig. 2.

hole is to be drilled to 10,000 ft. using 3½-in. IF drill pipe and 650 ft. of 4¾-in. drill collars with a 1¾-in. bore. Also assume that our rig has a 600-hp. pump with an 18-in. stroke; pressure ratings of the liners for this pump are:

| Liner size, in. | Maximum Pressure Rating, psi. |
|---|---|
| *5 | 2,600 |
| 5½ | 2,200 |
| 6 | 1,800 |

*Smallest liner available.

Based on mechanical and fluid-end losses, the pump is capable of delivering 500 hp. continuously. We want to design the hydraulics program from the bottom of the surface casing at 2,000 to 10,000 ft., we will use hydraulic-impact methods. Again we assume the mud weight about 10 lb. per gal.

As we pointed out in Part 10 of this series, we have three conditions to consider when maximizing hydraulic impact. First, we have the case where pressure is unlimited; then loss of pressure through the bit is from 71 to 75% of surface pressure.

Second, we have the case where surface pressure is limited and circulation rate remains constant; then pressure loss at the bit varies between 50 and 75% of the loss at the surface while using maximum surface horsepower.

Third, we have the condition where pressure loss through the bit remains at 46 to 50% of the pressure at the surface and surface horsepower is reduced.

If we use an annular velocity of 120 ft. per minute, we establish 120 g.p.m. as the minimum rate of circulation. From the above conditions, we can find the optimum rates of circulation from Fig. 2. These are shown in Table 1. Also, Table 1 gives a look at the actual horsepower it is possible to use at the surface.

Notice this: At no time was it possible to use the available 500 hp. Reason is the limitation placed on surface pressure by the pressure rating of the 5-in. liner.

Suppose we had used a smaller horsepower pump. With such a pump, we would use a surface pressure less than 2,700. This is because of liner limitations and a proportionate decrease in horsepower that could have been used. For an example, refer again to Fig. 2 and the curve for 400 hp. This time, we will assume that the maximum rating of the pump liner is 2,300 psi. The same program for this condition is shown in Table 2.

The percentage of surface horsepower that can be used is shown in the last column of both Tables 1 and 2. You can see there is little difference in the per cent of available horsepower that can be used in either case.

To use all of the power available we would need a pump capable of delivering small fluid volumes at high pressures. Even more important, we would need a different system of surface connections. These are not unreasonable conditions for future drilling operations. Suitable surface connections are already available and some believe plunger pumps will fill the requirements for pumping.

**Using all horsepower.** To show the results of being able to use all surface horsepower available, take one depth from Fig. 1, say 5,000 ft. Now, let us figure first the maximum impact and maximum bit horsepower available with pressure limited and 400 hp. at the surface. Then, check the programs with no limit on surface pressure. Table 3 shows the results.

In theory, it might be possible to double bit horsepower when surface pressure is not limited. However, there is a practical limit on the minimum size of bit nozzles. So, the increase is less in practice.

Actual increase in hydraulic impact is about 33%. Such an increase is important and certainly not impossible to achieve with proper equipment.

Make special note in these calculations of what happens below 5,000 ft. A pump capable of 400 hp. may be just as effective as one capable of 500 hp. It is only necessary that the 400-hp. pump operate at the same maximum pressure. This situation is even more pronounced using smaller drill pipe and drill collars.

This is but one example. We could cite an infinite number for the actual hydraulic requirements in small holes. Today's situation demands not bigger and bigger pumps and other equipment, but better and better use of what is available. We must emphasize the need for equipment which is sized to do the job.

We can't cut cost by using a 15,000-ft. rig to drill an 8,000-ft. well or by using a 10,000-ft. rig to drill a 15,000-ft. well. The same principle applies in drilling small-diameter holes. Some have made steps in the right direction by using small rigs for small holes.

Other problems remain. Hydraulics is one and it is not something which will solve itself or go away. For this reason, we should all be interested in developing new pumps.

**TABLE 1**

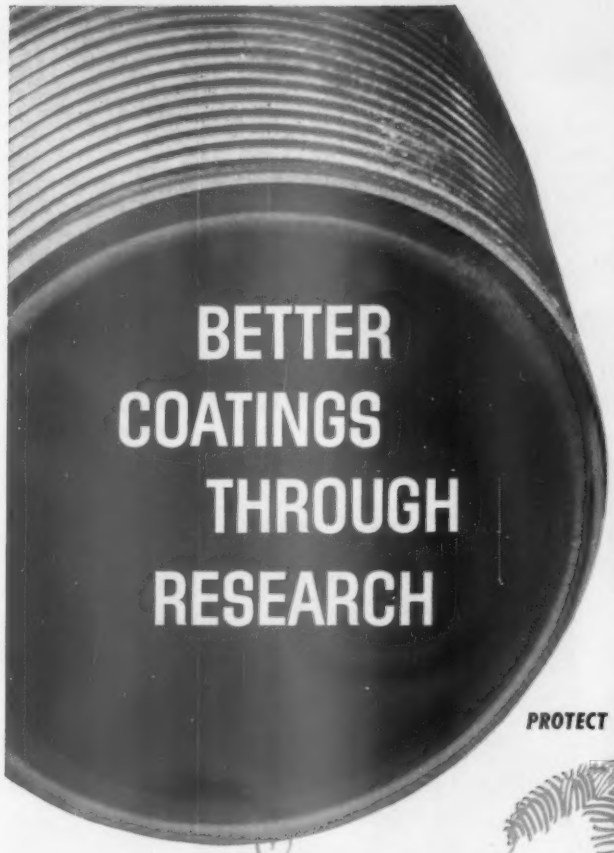
| Depth, ft. | Optimum circ. rate, g.p.m. | Pressure loss, at bit, psi. | Horsepower used at surface | Per cent of available hp. that is used |
|---|---|---|---|---|
| 2,000 | 305 | 1,225 | 480 | 96.0 |
| 5,000 | 255 | 1,225 | 401 | 80.1 |
| 8,000 | 222 | 1,225 | 350 | 70.0 |
| 10,000 | 205 | 1,225 | 323 | 64.5 |

**TABLE 2**

| Depth, ft. | Optimum circ. rate, g.p.m. | Pressure loss, at bit, psi. | Horsepower used at surface | Per cent of available hp. that is used |
|---|---|---|---|---|
| 2,000 | 275 | 1,060 | 369 | 92.3 |
| 5,000 | 235 | 1,060 | 315 | 78.9 |
| 8,000 | 205 | 1,060 | 275 | 68.7 |
| 10,000 | 190 | 1,060 | 254 | 63.5 |

**TABLE 3**

| Impact | | | Bit Horsepower | | |
|---|---|---|---|---|---|
| Optimum circ. rate, g.p.m. | Impact | Bit hp. | Optimum circ. rate, g.p.m. | Impact | Bit hp. |
| 235 | 84,100K | 145 | 185 | 73,000K | 161 |
| **Unlimited Conditions** | | | | | |
| Sur. press. = 3,400 psi. | | | Surf. press. = 5,540 psi. | | |
| 205 | 112,000 | 290 | 120 | | 343 |




**RESEARCH EFFORT:** ***To continue improving Plasticap coatings and application methods.***

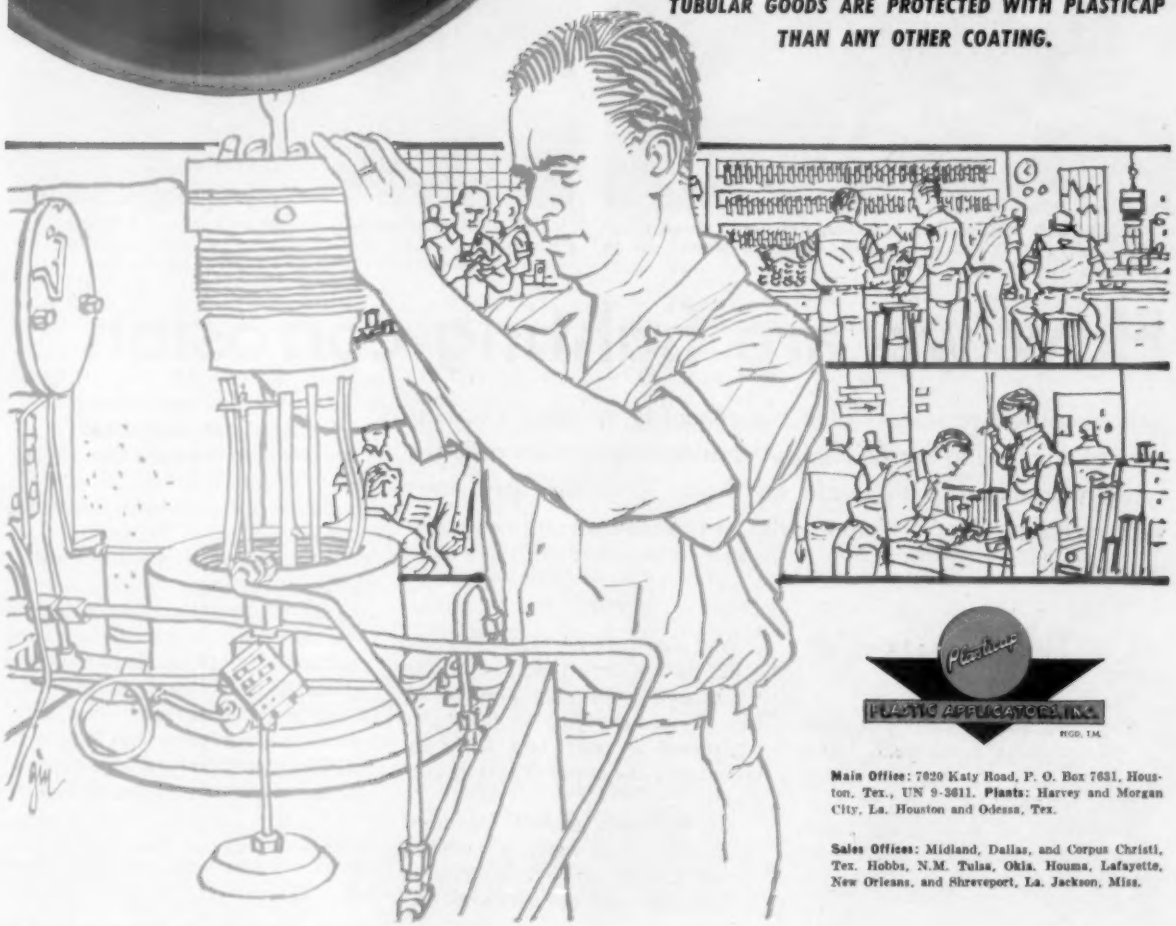
**RESULTS:** ***A series of successfully completed research projects and an expanded research program. Here are some of these results:***

- Additional new research facilities and personnel have been added recently to augment the continuous research program conducted for years by Plastic Applicators and independent research organizations under contract to Plastic Applicators. Man hours and dollars devoted to research have been constantly increased.

- New coatings developed through this research program have been introduced regularly. Most recent new coating released from the laboratories is Plasticap HTP, which was developed to provide lasting resistance to acids and caustics, even at temperatures above 350°F.

- Air dehydrators have been installed at all Plastic Applicators plants because research has shown that removing all water, oil, and other impurities from air used in the application of Plasticap coatings improves adhesion and resistance qualities of the coatings.

***PROTECT YOURSELF AND YOUR PIPE. SPECIFY PLASTICAP. MORE TUBULAR GOODS ARE PROTECTED WITH PLASTICAP THAN ANY OTHER COATING.***



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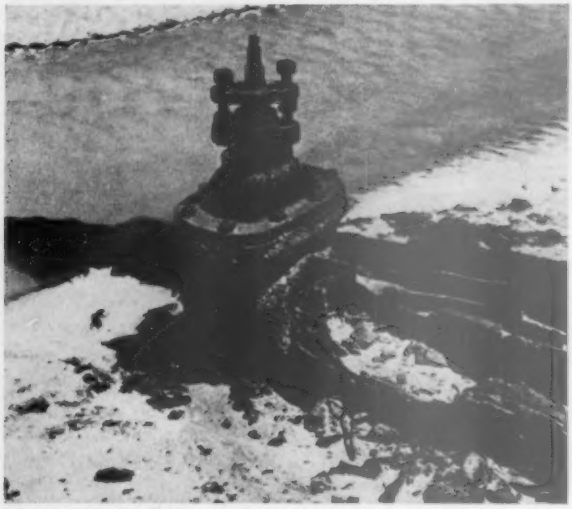
**THIS IS THE RESULT** of early-day salt-water-disposal methods, Fig. 1. This area was probably damaged by leakage from a . . .



. . . **CORRODED PIPE** used to transport salt water to an evaporating pit, Fig. 2. These old methods have given way to the new . . .

. . . **SALT-WATER-DISPOSAL SYSTEM** as in use in the East Texas field today. Cement asbestos gathering line is carrying salt water to this modern filtration-injection station. Fig. 3.

# How we are fighting corrosion

**Use of coated or nonmetallic equipment is the most popular way of combating corrosion. But coating application requires good workmanship to avoid holidays. Corrosion problems will increase in the future with more severe oil-recovery methods.**

BY H. D. HOLLOWAY
AND T. W. McSPADDEN
Pan American Petroleum Corp., Tulsa.

SIX BILLION barrels of salt water![1]

That's a lot of water.

But that's how much is produced by oil operators every year. And operators have to stay up nights figuring out how to get rid of it.

Thousands of dollars are spent every day in gathering and injecting this water into disposal or input wells.

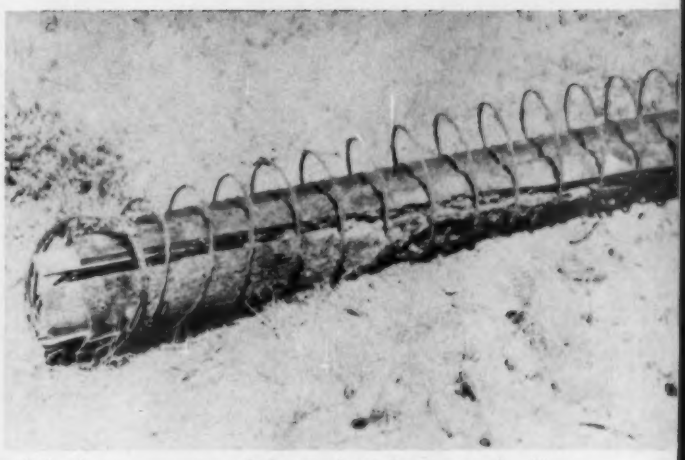
And that isn't all. Handling salt water means more than just buying the pumps, pipes, manifolds, tanks, etc. It means trying to keep this equipment in working order by eliminating the costly effects of corrosion.

An economic analysis of every lease where salt water is involved should include some consideration of corrosion and the additional expense of operation and equipment replacement.

And the situation will get worse before it gets better.

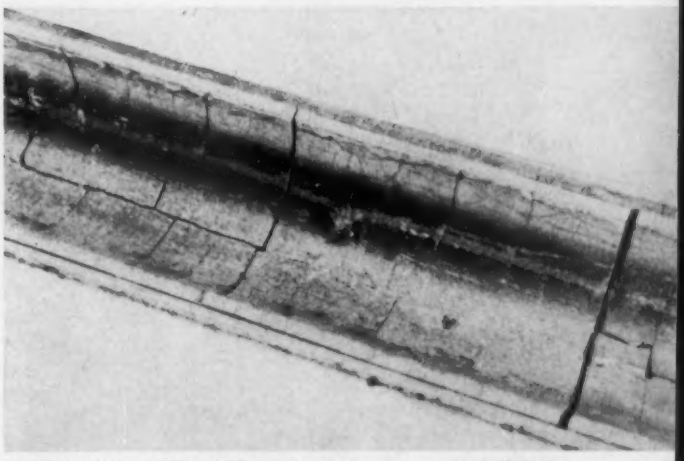
Reservoir engineers have figured out new ways to get oil out of the ground—like fire flooding. The products of combustion, dissolved in an already-corrossive brine make a solution with properties approaching those of the perfect solvent—there's no vessel or pipe to hold it.

Paper presented at South Central regional conference, National Association of Corrosion Engineers, Tulsa, under the original title, Corrosion in Water-flood and Salt-Water-Disposal Systems.



**WOODEN-STAVE PIPE** like this works well for a while, but soon fails due to corrosion of the steel reinforcing mesh. Figs. 4 and 5.

**SCALE ACCUMULATION** in this asbestos-cement pipe occurred immediately downstream from the gun-barrel discharge. This sample was taken from the Midland Farms salt-water-disposal system. Fig. 6.



**CEMENT-LINED STEEL PIPE** works well in some installations, but this is what happens if quality control is not exercised during manufacture. This sample came from Cedar Lake field, West Texas, after 11 months of service. Fig. 7.

### History

Early water-disposal systems used natural drainage to rid the lease of the undesirable byproduct of crude-oil production. Some fields still bear the scars of this "method," Fig. 1. Corrosion of bare steel pipe was also a frequent scene in some of the early oil fields, Fig. 2. Corrosion of bare steel lines resulted in leaks that in turn resulted in soil damage. To protect land, freshwater resources, and wildlife, subsurface disposal was developed by the oil industry. Today this is the predominant salt-water-disposal measure[3].

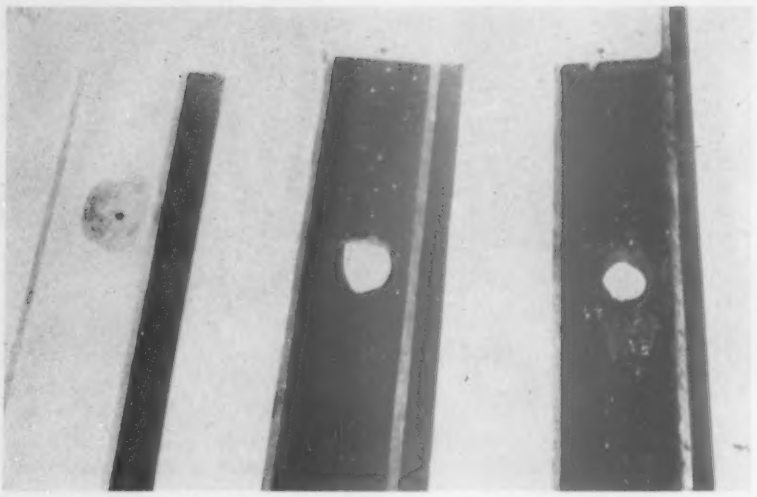
Importance of subsurface disposal was emphasized by results obtained in East Texas field, Fig. 3. As early as 1935 operators realized that unless the huge volume of salt water could be disposed of satisfactorily, the field was threatened with premature abandonment. Subsurface disposal was adopted with injection of the water into the aquifer of the producing formation. And this injection is resulting in a more efficient recovery of oil.

With the development of secondary recovery by water flooding, salt water has been converted from a liability to an asset by increasing reserves and ultimate recoveries. The importance of corrosion control arises from the fact that without it many of the now successful projects would never have been started.

**Early systems failed.** Early oilfield salt-water systems were designed on the basis of experience in municipal water and sewage systems. Wooden stave pipe installed under ground, Fig. 4, was satisfactory for protection against internal corrosion. But, the external steel-wire reinforcing, Fig. 5, was not protected and the result was complete failure.

A certain wrought-iron pipe that had withstood sea-water exposure (35,000 p.p.m.) for 47 years was installed in oil-field-brine service where solids content was 72,000 p.p.m. Normal life, instead of the expected 25 years, was only 2 years[4]. This dilemma still exists today, where a means of corrosion protection works well handling one corrosive water but fails when placed in a different water[5].

Open systems were used at first. But these introduced oxygen[6]. The closed system was adopted to eliminate or minimize this disadvantage with these results: (1) Solids pre-



**BAKED EPOXY** and phenolic linings must be free of holidays, or this is the result. Fig. 8.

cipitation is reduced, minimizing filtration requirements, (2) corrosion is reduced without using more expensive corrosion resisting equipment, (3) low initial investment, and (4) lower maintenance as a result of reduced corrosion[7].

**Corrosion-resisting materials.** The use of nonmetallic gathering lines, where pressure will permit, is usually desirable when handling oil-field brines[8]. Today, cement-asbestos and cement-lined steel gathering lines are found in use most frequently. Even these have their disadvantages.

### Current Practice

**Cement-asbestos pipe** meets the requirements of moderate pressures for salt-water gathering lines. The major shortcoming of this type of pipe is its tendency to shear if not properly installed and a tendency to accumulate scale, Fig. 6. This type of pipe has given years of trouble-free service in sour brine and sour-crude gathering systems. It is used extensively by the East Texas Salt Water Disposal Co. where engineers report that it is very saisfactory[2]. Some manufacturers are now experimenting with an epoxy-lined cement-asbestos pipe for prevention of scale. This is a recent development and little is known about this pipe.

**Cement-lined pipe** has been in use for years. Some operators report that it has given satisfactory service. Varying reports of 1 year to 20 years' life have been received. In Kansas cement-lined pipe with a life of about 20 years was reported in a system handling Arbuckle salt water. In West Texas sour salt-water service, life has varied from 9 months to 5 years on various systems. The reasons for many of the failures have generally been the result of poor quality control in materials or in manufacture, Fig. 7. Several producing companies have recently prepared their own specifications for cement and mortar linings. The literature contains little information about cement linings for oil-field service. Specifications to control the quality of these linings should result in improved service life.

**Plastic-lined pipe** is a development introduced about 1942. Application of baked-on resin coatings on inner walls of steel pipe and tubing is a good way to prevent corrosion in high-pressure gathering and distribution lines. Baked-on phenolics have given dependable service for the more extreme conditions.

Quality control during application is an important factor determining the life of thermosetting plastic systems. Laboratory experiments show that thermosetting resins will resist corrosion in typical oil-field services. Failures are the result of application procedures which do not provide the proper base for the coating, and result from holidays. Fig. 8 shows the effect of holidays in thermosetting coatings of injection well tubing in a West Texas salt-water-disposal system. Manufacturers are now developing holiday detectors and thickness-testing devices.

**Plastic pipe** has been used in salt-water service on a limited scale. It is limited in its application by poor performance at elevated temperature and pressure. The maximum allowable working pressure which operators will impose on 2-in. pipe is approximately 75 psi. at 80° F.

One of the longest records of service reported for plastic pipe was 10 years in Max field, Central Kansas. This pipe was made of cellulose acetate butyrate. Satisfactory performance and length of service was largely due to the low pressure (approximately 7 psi.) to which the pipe was exposed while handling corrosive Arbuckle salt water.

Polyvinyl chloride and the acrylonitrile butadiene styrene plastics have been the most satisfactory performers of the thermoplastics in oil-field service. These are now being used without further testing, but are still limited to lower temperatures and pressures. A recently developed linear acetal resin plastic offers promise of additional strength for plastic pipe and consequently it may develop into a material for use in place of steel for many applications. Several thousand feet are now on test in both salt-water and sour-crude service. The results of the tests up to now are very encouraging. The price of this pipe is attractive also.

Working-pressure limitations have been partially overcome by the development of reinforced plastic pipe. Reinforced plastic tubing has been in service in a Kansas salt-water-disposal project since 1952. This tubing has been pulled and inspected twice since installation, and continues to give satisfactory service.

**Inhibitors** can be used in water systems, but cost may limit their general use. Film-forming, water-dispersible inhibitors are generally more effective and less expensive when used by batch-injection methods. Optimum treating rates can be found by using test nipples throughout the system.

Water-soluble inhibitors are commercially available. These are used mostly for bacterial control with weak corrosion inhibition as a sec-

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2. *The "Double Dip" is identical to the spherical FREE-O-FREEZ except that it processes two well streams in the same unit at the same time.*

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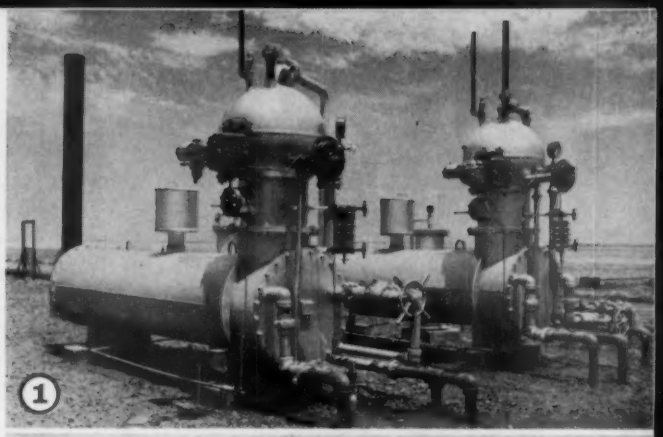


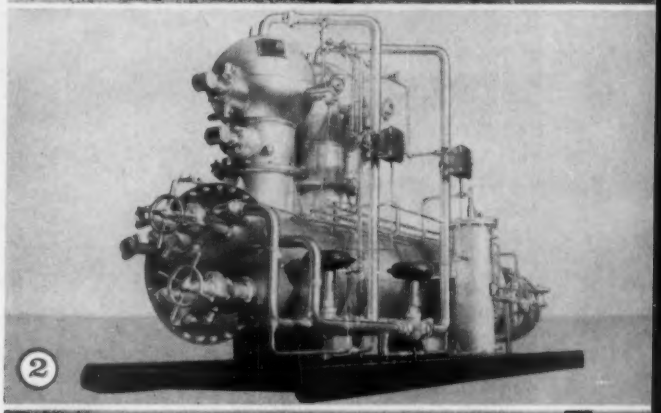


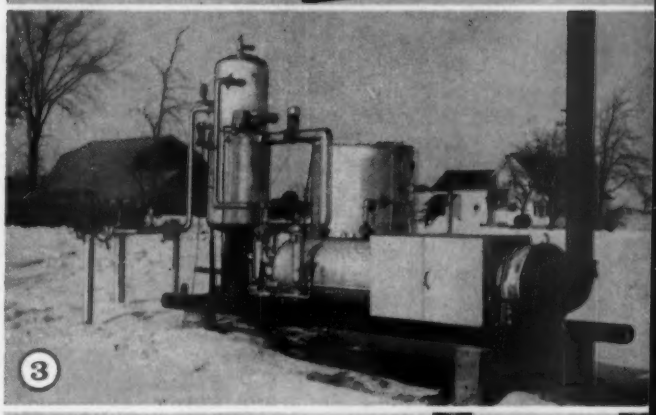


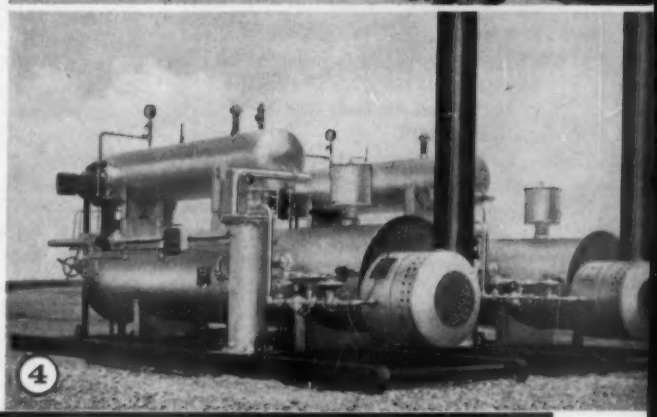


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ondary effect. There is a combination water-soluble inhibitor-bactericide that is being field tested and results are encouraging.

**Surface vessels and equipment** can be protected cathodically or manufactured from corrosion-resistant materials.

Where a.c. power is unavailable some vessels are protected with carbon anodes and engine-driven d.c. generators, or magnesium anodes. Where carbon anodes are suspended in water vessels, movement of the water can cause chafing of the anode lead wires and insulation failure. Recent installations have used grooved nipples for quick-change couplings welded into the vessels and carbon anodes with special quick-change coupling heads to provide rigid support for the anodes. This method of anode mounting has eliminated the earlier problem of chafing.

Magnesium anodes are used in most glass-lined vessels to provide protection to the vessels in case there are holidays in the linings. Current density required for protection will vary from 4 to 14 ma. per sq. ft. depending on the conditions. Vessels with compartments must have anodes in each compartment for complete protection. No protection is given to surfaces not contacted by the electrolyte in which the anodes are immersed.

Injection water has been metered by positive-displacement meters, orifice meters, pitot tubes, weirs, and other miscellaneous measuring devices. Early use of positive-displacement meters, mainly nutating disk type, was not satisfactory in most sour-brine service. Many operators then turned to the use of orifice meters.

Orifice meters are hard to protect from corrosion, particularly if installed in a conventional meter run. Corrosion of the manifold and meter elements is sometimes controlled by filling with an inhibited solvent such as trichlorethane and installing the meter below the run.

The solvent has a higher specific gravity than the corrosive water and will prevent it from coming in contact with the meter parts. It has proved difficult to maintain this inhibitor barrier in most installations. A rubber-lined positive-displacement meter with rubber-coated vanes has been successfully tested in some very corrosive environments.

Reciprocating pumps for corrosive salt-water-disposal and waterflood service are usually equipped with aluminum-bronze fluid ends and corrosion-resisting trim. Ceramic plungers, hardened-steel plungers, and stainless-steel fluid ends have also been effective in selected installations. Centrifugal pumps are selected with special high-nickel, high-chromium, molybdenum alloy cases and bronze impellers.

Air-dried coal-tar epoxy is exceptionally good as an internal lining for tanks. Coal tar has been in service for as long as 4 years with very few failures. Those few failures which have occurred were the result of faulty preparation and application. As with cement linings, specifications for application of air-dried coatings might improve the performance of the coatings.

Molded reinforced plastic tanks have recently been introduced for testing. These tanks are now in sour crude service in West Texas and Kansas. The installed cost of these tanks was slightly greater than coated steel tanks.

Other miscellaneous coatings and alloys are sometimes used. One that warrants brief mention is a chemically applied nickel-phosphate coating. It now costs approximately $2 per mil. sq. ft. which is nearly prohibitive. However, coating of low-alloy valves might be practical. A field test of mild-steel valves with this coating in sour salt-water-injection service is being watched with interest in a West Texas salt-water-disposal project.

**Outlook.** The lives of reservoirs under secondary recovery are generally extended from 5 years up. Constant replacement of equipment is often the result of inadequate planning for corrosion protection. Emphasis is often placed on chemical treatment to preclude formation plugging, while limited thought and consideration is given to corrosion. This is not practical when formation plugging in an injection well may be much less expensive than collapsed casing caused from corrosion.

Corrosion of equipment used in future recovery methods will undoubtedly be more difficult to combat. In situ combustion will expose equipment to more corrosive conditions than waterflooding. Deeper formations will also pose more severe conditions due to higher temperatures and pressures. These and many more extreme conditions not now anticipated must be met if all of the eventually recoverable crude in our nation's reservoirs is to be produced with optimum practical return.

## Conclusions

1. There are five general methods of mitigating corrosion in waterfloods or salt water disposal systems. These are:

(a) Use of coated or non-metallic equipment.

(b) Cathodic protection of equipment.

(c) Chemical which inhibits the corrosion process.

(d) Treating the water to change its properties.

(e) Use of metals that resist corrosion.

At this time the predominant method is the use of coatings and nonmetallic equipment.

2. Success of coated equipment is always predicated on the quality of workmanship.

3. Holiday-free coatings are considered essential for complete protection when plastics are used.

4. Corrosion problems will increase in the future as deeper formations are penetrated and more severe oil-recovery methods come in use.

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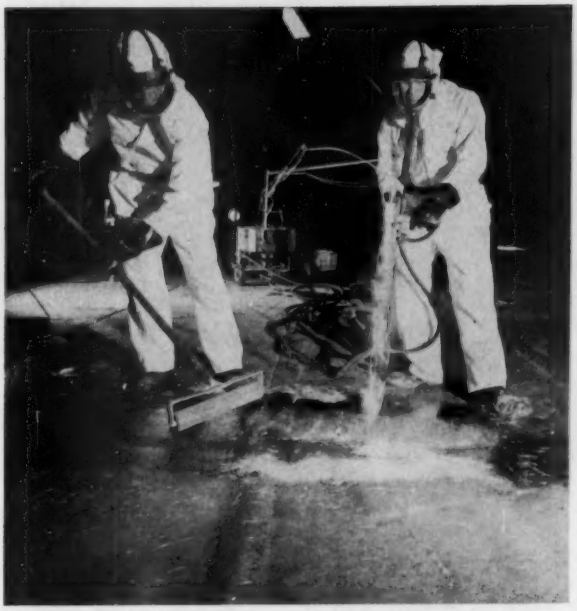
**MIXING** of the two types os isopolyester resins is performed outside the tank.



**SPRAYING** chopped glass fibers and plastic onto tank bottom. Rollers squeeze any air out of laminate.

# New plastic combats tank-bottom corrosion

## . . . and cuts maintenance cost 50-70%

AFTER 2½ YEARS of extensive trial applications, a new group of plastics is proving quite useful in combating corrosion and cutting maintenance costs, particularly in storage-tank bottoms.

These new isopolyester resins have been undergoing rigid tests since 1958 in a variety of applications by Standard Oil Co. of California-Western Operations, Inc., at its Richmond refinery near San Francisco. The Oronite Division of California Chemical Co. in affiliation with California Research Corp., subsidiaires of SOCAL, pioneered the commercial development of isophthalic acid—the commercial raw material on which isopolyesters are based.

The isopolyester resins have proved valuable in the following applications: as reinforced coatings for tank bottoms; as patching compounds to repair cooling coils, valves and leaky lines; and as clear coatings to protect the interior of valves, pumps, tanks and other new equipment before it is placed in service.

**BY D. H. STORMONT**
Refining Editor

Some of the equipment repaired by isopolyester resins has been in service the full 2½ years and an inspection just completed did not reveal any signs of failure or pending failure in repairs with reinforced isopolyesters.

**Cost saving.** In addition to long life, use of isopolyesters also offers marked savings in cost compared to conventional maintenance methods.

For example, it usually costs between $3 and $4 per square foot to replace the bottom of a small refinery tank (60 by 10 ft.) with new steel plates. And a down time of 30 days is common. The repair of this same size tank using isopolyesters requires only 10 days' down time and there is an estimated saving of from 50 to 70% in labor and materials compared to the cost of replacing with steel.

The tank bottoms which have been successfully repaired at Standard Oil's Richmond refinery with isopolyester resins mixed with glass fibers are being used in such service as diesel oil, crude oil, ballast water, gasoline, ammonium sulfate, and concentrated phosphoric acid. Other reinforced applications include repairing a decal bath pan used in dilute alcohol service, a control valve used in salt-water service, and a fume scrubber used in acidic water service.

Unreinforced coatings have been successfully used to repair such equipment as control valves, sump pumps, skimming tanks, bins, centrifugal compressors, and precipitator pans. The service this equipment is used in includes concentrated ammonium nitrate solution, gasoline, salt water, and dry sulfate.

Polyester patching repair has been successfully accomplished in tanks primarily used in lube-oil and gasoline service, an alkyl benzene vessel, a gas holder, strainers in salt-water service, an exchanger in alkyl benzene service, a salt-water valve,

Congrats and $25.00 to Charles L. Mizer, 114 Lexington Ave., Taft, Calif.

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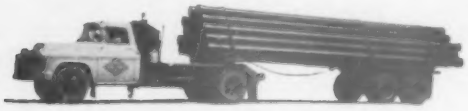

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water pump, sump-tank piping for an underground solvent drain, and line applications for alkyl benzene, salt water, and fresh water.

**Different coatings.** By varying the formulations of the isopolyesters the properties of the coatings can be varied widely. Flexible resins with excellent impact properties are produced as well as rigid resins with outstanding high-temperature properties and good chemical resistance.

The resins usually are received in styrene solutions. Additional styrene sometimes is added at the job site to facilitate mixing and application. To cause the resins to cure, catalysts such as methyl ethyl ketone peroxide or benzoyl peroxide are added at the job site. In addition, cobalt napthenate or dimethylaniline is added as a "promoter" to facilitate setting at room temperature.

Though the new isopolyester coatings will not be a cure-all for corrosion, they do offer certain advantages if they continue to perform as they have. They are relatively low cost and nontoxic. They adhere well to various materials, have good chemical resistance, and have good strength-retention properties.

Thick coats of unreinforced isopolyester resins can be applied in one pass since they are in the so-called solventless coatings class. On horizontal surfaces care must be taken to keep the coats down to 10 or 12 mils or the exotherm temperature may be high enough to damage the coating. This is particularly true for second and subsequent coats.

**Tank bottoms.** Use of the glass-reinforced laminates to completely cover badly corroded tank bottoms is a particularly interesting development. Although 2½ years of trouble-free service with no signs of future failure is not conclusive evidence, it does indicate that the laminates have high initial strength and can retain their strength under load for a long time.

The method of applying the reinforced tank bottom laminate was developed at the Richmond refinery of Socal. The steps ars as follows:

The bottom of the tank is first sandblasted, and the sides of the tank up to approximately 3 ft. from

**"Though the new isopolyester coatings will not be a cure-all for corrosion, they do offer certain advantages if they continue to perform as they have."**

bottom. To avoid overnight rusting a thin clear isopolyester coating is sprayed on. Final preparatory step is to fill holes and level out joints, using an isopolyester resin containing 2 to 9% of silica gel.

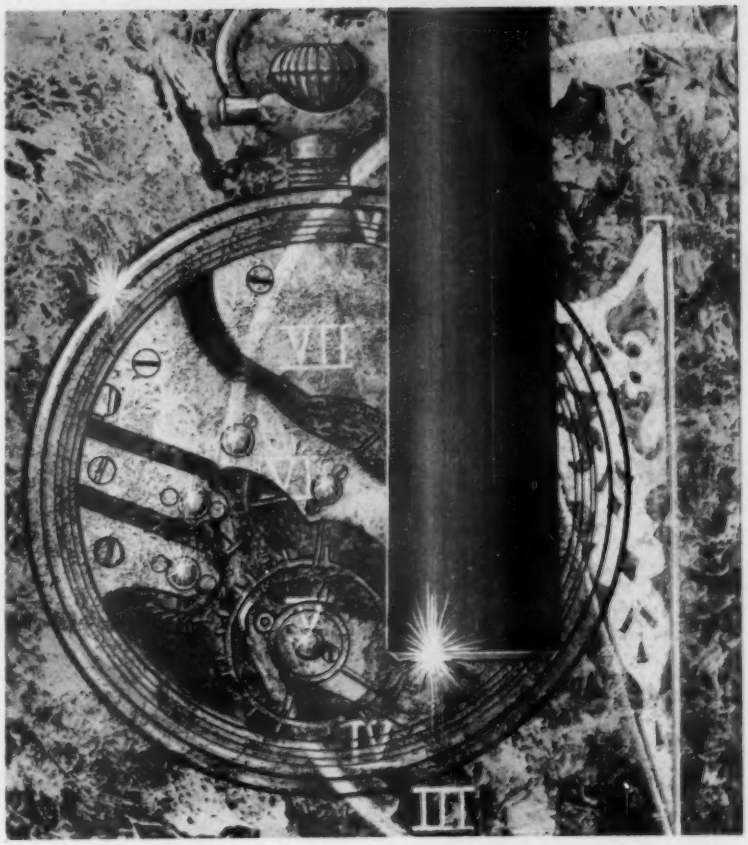
The glass laminate then is sprayed on by a five-man crew. The double-barreled spray guns used are equipped with glass choppers which cut the glass roving into lengths of about 1½ in. As the glass-isopolyester coat is sprayed on, men equipped with rollers squeeze the air out of the laminate (see photograph).

To complete the laminate, which has a total thickness of about 0.2 in., a thin coating of isopolyester is sprayed on. The final coat also contains wax to promote surface cure of the resin. This assures that no uncoated glass sticks out from the laminate.

Equipment used in applying the more recent reinforced coatings include a moving platform inside the tank and a trailer which is left outside (see photograph). The latter carries two drums of isopolyester, one catalyzed and the other promoted, and the pumping equipment. Flexible hoses carry the resin to regulators mounted on the moving platform, and from there to the spray guns. Air for atomizing the isopolyester, and for operating the glass choppers, is supplied by a portable compressor placed outside the tank.

The mobile platform carries the glass supply. As shown in the photo, telescopic booms carry the glass roving to the glass choppers and sprayers. Late models of the platform supply four strands of roving to each spraying unit.

The isopolyester coating system, as generally applied, consists of 100 parts of resin, 1 part of catalyst, and 0.3 parts of promoter. Gel time of the final mix is between ½ and 1 hour. The streams of catalyzed and promoted resins are directed so that they meet just prior to striking the tank bottom, wetting the glass fibers as they descend.

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# Cost of refinery investment

BY W. L. NELSON
Technical Editor
and Petroleum Consultant

THE COST of individual process units can be estimated from various issues of the Cost-imating series (35 issues, November 7, 1955, p. 127 through September 2, 1957) and especially Nos. 14 (July 16, 1956), 20 (November 5, 1956), and 26-32 (March 11, 1957, through June 10, 1957). Each process unit should carry its proportion of offsite facilities. Such extra investment costs can be allocated in proportion to the amounts of utilities required by each process, but the bookkeeping is greatly simplified if offsite investment costs are allocated on a basis of the cost of each process unit. If the latter method is used, the cost of steam, water, and power charged to each unit should not include retirement of the investment in steam plants, water systems, or power plants.

In obtaining the total investment of a refinery installation, the costs of each of the units is summed as indicated in Table 1 including such items as storage tanks, and total steam generation. On such a basis, the cost of offsite facilities as percentage of the investment in process equipment ranges somewhat as follows:

| | |
|---|---|
| Fuel-type refineries | 40% |
| Average refineries | 43% |
| Lube refineries, 12% | 48% |
| Lube refineries, 22% | 55% |
| Asphalt refineries | 65% |

As an illustration, Table 1 shows the cost of an average 30,000-bbl. per day refinery containing processing facilities that are typical of 1956 or 1957. Yields for the operation indicate the sizes of the various process units, but in this instance, the average yields and processes for 1956 (Process Costimating Nos. 78 and 82, August 29, 1960, p. 103, and October 24, 1960, p. 104) are used. Costs are dated 1946 and these may be converted to other years by means of the Nelson Refinery Construction Cost Index (Cost-imating No. 36, August 5, 1957) published in the first issue each month of The Oil and Gas Journal.

**TABLE 1—PROCESSING OPERATIONS AND COST ($/DAILY BBL.) OF AVERAGE 1956 REFINERY (34.5 API CRUDE OIL)**

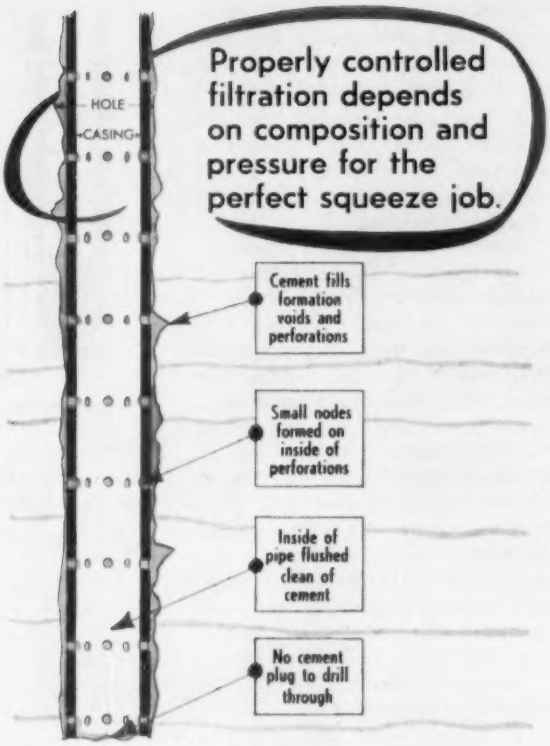
| Operation— | Bbl. processed per bbl. crude oil | Ave. size of unit, B/D* | 1946 Process unit cost, $/daily bbl. | Ref.† | 1946 Investment cost, $/daily bbl. |
|---|---|---|---|---|---|
| Desalting | 1.000 | 30,000 | 3.00 | 26 | 3.0 |
| Topping | 1.000 | 30,000 | ¶22.00 | 26 | 22.0 |
| Vacuum flashing | 0.194 | 10,000 | 32.00 | 26 | 6.2 |
| Thermal—cracking | 0.185 | 6,000 | 160.00 | 28 | 29.6 |
| reforming | 0.035 | 2,000 | 200.00 | 28 | 7.0 |
| coking | 0.034 | 5,000 | ‡270.00 | 28 | 9.2 |
| vis. brk. | 0.040 | 3,000 | 145.00 | 28 | 5.8 |
| Catalytic—cracking | 0.390 | 12,000 | 265.00 | 28 | 103.0 |
| reforming | 0.111 | 4,000 | 265.00 | 27 | 29.4 |
| Asphalt manufacture | 0.060 | 5,000 | ‡150.00 | 30 | 9.0 |
| Polymerization | 0.014 | 800 | 500.00 | 26 | 7.0 |
| Alkylation | 0.028 | 2,500 | 820.00 | 26 | 23.0 |
| Hydrodesulfurization | 0.052 | 2,000 | 100.00 | 26 | 5.2 |
| Sweetening, TEL, inh., etc. | 0.488 | 5,000 | §35.00 | 30 | 17.1 |
| Other light-oil treating | 0.044 | 3,000 | §20.00 | 30 | 0.9 |
| Lube—finished oil | 0.021 | ..... | ..... | .. | ..... |
| vacuum dist. | 0.050 | 5,000 | 100.00 | 26 | 5.0 |
| extraction, solvent | 0.042 | 4,000 | 275.00 | 26 | 11.5 |
| dewaxing, solvent | 0.018 | 1,500 | 635.00 | 26 | 11.4 |
| rerunning | 0.040 | 2,000 | 125.00 | 26 | 5.0 |
| decolorizing | 0.021 | 1,500 | 390.00 | 27 | 8.2 |
| Storage—crude | 40.0 | 45,000 | 0.70 | 3 | 28.0 |
| products | 40.0 | 4,000 | 1.50 | 3 | 60.0 |
| Steam—lb. per hour | 6.0 | 75,000 | 1.20 | 14 | 7.2 |
| Approx. process-unit cost (1946) | ..... | ..... | ..... | .. | $414.70 |
| Offsite facilities, 43% | ..... | ..... | ..... | .. | 178.00 |
| Refinery investment cost during 1946 | ..... | ..... | ..... | .. | $592.70 |
| Refinery investment cost during 1956 | ..... | ..... | ..... | .. | ‖$1,160.00 |
| Refinery investment cost during Nov. 1960 | ..... | ..... | ..... | .. | ‖$1,360.00 |

*Significant only in obtaining a suitable per barrel cost. †Issue numbers of the new Cost-imating Series (Nov. 1955—Aug. 1957). ‡Increased to include handling or finishing facilities. §Estimate. ¶Reduced for combination operations. ‖By Nelson Refinery Construction Cost Index (1956 = 195.6), published in the first issue each month of The Oil and Gas Journal.

Here's how Gulf improved its

# Formation cement squeezes by using low-water-loss cements

BY H. J. BEACH, T. B. O'BRIEN, AND W. C. GOINS, JR.
Gulf Oil Corp., Houston


Properly controlled filtration depends on composition and pressure for the perfect squeeze job.
HOLE
CASING
Cement fills formation voids and perforations
Small nodes formed on inside of perforations
Inside of pipe flushed clean of cement
No cement plug to drill through

PART 1

AS LATE AS 1955 and 1956, Gulf Oil Corp. was having no better than about 60% success in cement-squeeze jobs of its wells in one typical area.

Now, with new low-water-loss cements, 17 of 20 jobs have been successful. Moreover, big savings have been made by conducting the squeeze jobs so that no cement ordinarily need be drilled out afterwards.

Probably the most spectacularly successful job with the new method was on a well in Yoakum County, Texas. There, using only 100 sacks of cement, 230 ft. of open perforations were successfully squeezed in a single stage.

We have found that the old practice of squeezing to some high final pressure is no assurance that the job will be successful. Very often when the final pressure does go as high as planned, it is because the cement inside the casing has dehydrated as a result of its high filtration rate. The dehydrated cake in the casing resists further movement of the slurry. Thus, the cement may not reach all points which should be squeezed off. And, when the cement is drilled out, the squeeze proves a failure.

Answer to this problem, we believe, is in carefully formulated slurries with low filtration rates. These can be squeezed into perforations without dehydrated cement blocking the casing. Added to these cements is a process of prolonged and intermittent pumping. Such "hesitation" promotes the building of cement filter cake in the open perforations. Eventually, this allows pressure to build and force cement into the more resistant perforations.

Additives we have tested yield slurries with good filtration rates which can be pumped for longer periods. Result is a compact filter cake which can set strong even while the parent slurry remains fluid.

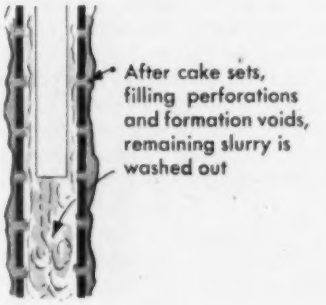
Slurry remaining in the hole after such jobs can be washed out. Then, after the cake has set, you may test perforations and reperforate without drilling cement or removing the packer. Or, you may squeeze again if necessary without coming out of the hole.

A normal job may require from 3 to 6 hours.

**The old approach.** Some time ago, we checked 260 squeeze jobs performed on the Gulf Coast during 1955 and 1956. From this check, we found several conditions which reflected the common opinions of that time about squeeze cementing:

1. Often, there were attempts to get a final squeeze pressure as high as 1 psi. or more per foot of depth at the point of squeeze.

2. Mostly, 125-200 sacks of cement was used per stage, and many thought most of the slurry must be displaced for a successful job.




This is the first of two parts. The second will appear in an early issue of the Journal. Both installments are from a paper titled, "The Role of Filtration in Cement Squeezing" presented by the same authors to the 1961 spring meet of API Division of Production's Southern District, Shreveport.

3. If final, calculated bottom-hole squeeze pressure was less than 1 psi. per foot, all the cement was usually flushed from the hole.

4. Hesitation pumping to aid pressure buildup was regarded as hazardous, so pumping was usually continuous although slower as squeezes developed.

There were 90 sets of perforations squeezed (25 isolation, 65 production) using 171 stages, a ratio of 1.9 stages per set. One hundred and three stages attained overburden (1 psi. per foot) or near overburden pressure. A total of 97 stages were drilled out and tested; the remainder flushed and re-squeezed. Eighty of the tested stages attained overburden or near overburden pressure; 54 of these tested successfully and 26 failed, a success of 62.5%. Of the 17 stages not attaining overburden pressures, 10 tested successfully for a success ratio of 59%.

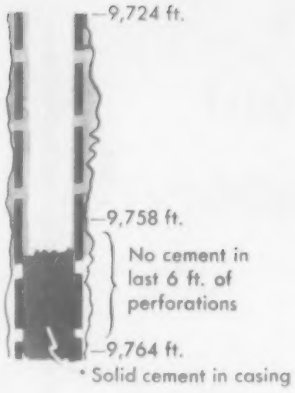
From these results, we make the following conclusions:

1. A high final pressure is no more assurance of success than is a lower squeeze pressure.

2. Many of the discarded stages would have tested successfully if lower final squeeze pressures had been accepted.

**Why the failures?** Note that 40% of perforations squeezed to high pressure failed to withstand test even though the cement was allowed to set before testing at pressures equal to or less than the squeeze pressure. What are the reasons for these failures? We think we found them in the core from a conventional squeeze job.

The well core is in Wadsworth field, Texas. It contained a 26-ft. perforated interval from 9,744 to 9,770 ft. The formation broke at 8,670-lb. calculated bottom-hole pressure (c.b.h.p.) and accepted fluid at 7,400-lb. c.b.h.p. The squeeze slurry consisted of 100 sacks of API Class E cement mixed to an average density of 16.1 lb. per gal. Pumping continuously and progressively slower, we displaced 93 sacks through a retrievable tool set at 9,635 ft. There was one pressure break back from 9,470 to 9,070-lb. c.b.h.p. about the middle of the squeeze. Maximum and final squeeze pressure was 11,000-lb.




c.b.h.p. (6,000 psi. surface pressure). After pulling the squeeze tool, we found the top of the cement with a rock bit at 9,640 ft. and dressed it to 9,724 ft.

Coring began with a 6½-in. o.d., 3½-in.-i.d. diamond bit at 9,724 ft. 24 hours after squeeze. For 34 ft., rate of penetration was fairly constant at 1 ft. per 15 minutes. At 9,758 ft. the core barrel apparently jammed. When 1½ hours elapsed in drilling 2 ft. of hole, we decided to pull the barrel and bit.

A later trip with a rock bit revealed that the next 4 ft. of casing contained solid cement but that the last 6 ft. of perforations contained no cement.

Twenty-eight feet was recovered of the 36 ft. cored. There was a well-defined flow channel through the core. This passed outside the recovered material in places where it flowed through the cutting circle of the bit. Soft mud cake filled the channel for the first foot; soft cement the next 8 ft.; and hard cement the remainder.

**Density indicates a cake.** At the top of the core, 20 ft. above the perforations, density was 17.3 lb. per gal. Density increased slightly to a point about 6 ft. above the perforations and then sharply about 17.7 to 19.7 lb. per gal. in the next 3 ft. From this point 3 ft. above the perforations to the bottom of the recovered core (17 ft.), average density gradually increased to 20.3 lb. per gal. Some samples measured as high as 20.7 lb. per gal.

In contrast, cement filter cake prepared in the laboratory with a 1,000-lb. differential had a density of only 19.05 lb. per gal. This indicates that the interval of high density in the core was compressed filter cake.

It is clear that the casing in the perforated interval and 3 to 4 ft. above contained filter cake. Initially, the flow of cement was into some or all of the upper 20 ft. of perforations, but cake began to form in the interval gradually closing it off. This increasing restriction in the perforations narrowed the area of flow until only the cement in the thin channel was flowing.

When this channel finally closed through dehydration, overburden pressure could be and was developed at the surface. But the presence of cake prevented the high pressure reaching the lower 6 ft. of perforations! These perforations were not broken down and did not receive cement. In fact, no cement flowed into the bottom 6-ft. interval.

Above the perforations there was some dehydration through all the core recovered. Apparently the thickened cement caused a small flow channel to develop also in this interval.

**Gel results in channel.** What does the presence of mud cake in the channel at the top of the core indicate? The channel, filled with mud solids from drilling-fluid water, probably existed through the 84 ft. of cement drilled before coring. It likely also extended through the cement in the packer and drill pipe at the time of reversing excess slurry.

The drilling-fluid water was red-colored from mud solids. This water was pushed down the slurry column and tended to channel through the cement cake while the mud solids were filtering out. Gel strengths are very high for conventional cement slurries which are almost motionless when obtaining final squeeze pressure. This makes it entirely reasonable to assume a gelled slurry and flow in a channel in the upper undehydrated part of the core.

For an example, consider a simple filtration test on a cement slurry containing no water-loss-control additives. Take a pressure differential of 100 lb. on a slurry against a medium of filter paper or fine-mesh screen. Separation of water from cement solids is almost instantaneous. We can calculate a total filtrate volume of 1,000 to

2,000 cc. in 30 minutes and a cake thickness of several inches.

These results explain why conventional squeezes appear to be more successful with high pressures, substantial quantities, and continuous pumping:

1. High pressure prolongs the movement of rapidly caking cement to a maximum number of perforations.

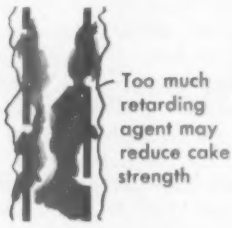
2. A lot of dehydrating cement must be sacrificed quickly to the perforations which break down first. This must be accepted so the slurry following is fluid enough to move to more resistant perforations.

3. Continuous pumping naturally results from the first two expediences.

### The Remedy—Control of Filtration Rate

From our studies, we were led to the following conclusions:

1. Low-filtration-rate slurries are necessary to prevent choking of



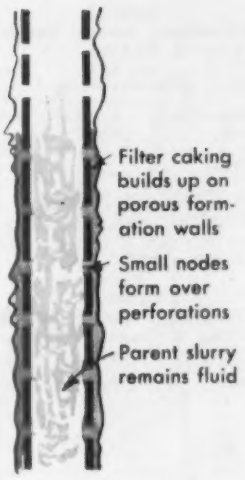

casing and isolation of perforations during squeezing.

2. High pressure is necessary to force cement into perforations filled with mud cake but not into clean perforations.

3. Although squeeze pressure is more difficult to obtain when low-filtration-rate slurries are flowing into readily accepting perforations, extended pumping time and hesitation can be used to fill voids and perforations with filter cake.

4. Usually, little cement is needed to seal perforations and voids behind casing. The goal is to build filter cake with a small volume of slurry rather than to force large volumes into pressure-created fractures.

Since the study, we have proved that by controlling filtration and retarding the slurry, we can place cake into all perforations and formation voids without hurrying. And, we can reverse out the excess slurry not used in cake formation. Filter




caking builds up only on areas of porosity and forms no more than small nodes over perforations inside the casing. The parent slurry remains fluid in the casing even in the perforated interval.

We use full-bore, retrievable cementing tools with tubing extensions. These permit us to squeeze, wash the perforated pipe free of cement, and leave only dehydrated nodes in the perforations. Then we can pressure or dry test, reperforate, test for production, and repeat any or all of these operations without pulling pipe from the hole.

To be able to do these things we must put stringent specifications on cement. So, during the past 4 years, we have tested three filtration additives in more than 100 squeeze jobs. Others are attempting to develop comparable materials.*

### Required Properties

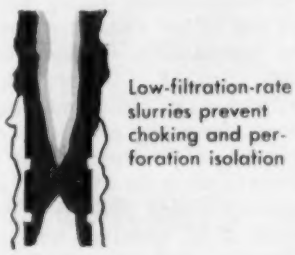
We can now list the properties we feel essential to success in squeezing with low-fluid-loss slurries. First, the slurry must remain fluid for 4 to 7 hours. Prolonged fluidity depends on two factors: filtration rate and retardation. Filtration must be controlled by some additive to prevent dehydration in the casing. Setting time can be controlled by some additive compatible with the first.

Second, the filtration agent must have no more than weak retarding power. This requires an unusual material because most which reduce filtration rate also retard setting time. This often results in too much retarding to get proper control of filtration. Also, fluid-loss agents concentrate in the filter cake. If they are strong retarders, they may kill cake strength.

It might appear that a single additive for both purposes would be cheaper and simpler. But, this is not the case. We have seen cement filter cakes that remained soft long after parent slurries had set hard. These were cases where strong retarders were used to reduce filtration.

Third, the retarder should affect filtration little or none. If it does not, it allows filtrate to leach it from the cake and permit rapid set of the cake even though the parent slurry remains fluid for several hours.

Fourth, filtration rates must remain stable the entire time slurry




contacts the formation. Most additives fail in this respect, having only temporary control over water loss. In a squeeze of 3 or 4 hours some perforations will break down and be sealed at the beginning. Some, perhaps, aren't sealed until near the end of the squeeze period. Loss of filtration properties in the interim would frustrate the process.

Fifth, water-loss additive should not add to the tendency of cement to gel when immobile for long periods; ideally, the additive should reduce this tendency. You cannot control the slurry well during squeezing if much pressure is required to move gelled cement after a period of pump hesitation. For

*For a description of the present material, "Flac," see The Oil and Gas Journal, August 1, 1960, page 119.

the same reason, the additives should not increase slurry viscosity.

**Filtration rate.** When you build cake in perforations, the time required depends on filtration rate of the slurry. When the filtration rate is a maximum, as in conventional cements, placement time is minimum. Conversely, if filtration is the lowest possible, the time to deposit adequate cake becomes too long.

We cannot hope to standardize on a placement time for slurries; filtration rates would have to be adjusted to formation conditions which are likely unknown. We find it simpler and more practical to standardize filtration rate and take whatever time is necessary to build filter cake. Using a standard filtration rate, we have completed jobs in 2 hours against highly porous sand and in less than 6 against almost impermeable, fractured limestone.

Filtration rate has no meaning in squeeze cementing unless we consider the solids content. The important factor is the amount of cake deposited. There should be only enough to fill formation voids and perforations and leave small nodes inside the casing. Too much caking causes enlarged nodes to form. Too little caking prevents us building and holding squeeze pressure.

Our experience over 3 years leads us to use a slurry with a water-to-solids ratio of 0.40 and an API fluid loss of 50 cc. in 30 minutes under a pressure differential of 1,000 lb. Such a slurry has satisfactory caking for nearly all squeeze situations.

We make the filtration test against a 325-mesh screen at the temperature of the point of squeeze 1 hour after mixing. Immediately after mixing, the slurry is placed in an API high-pressure consistometer, and we simulate the squeeze-cementing schedule of API RP 10B corresponding to the well temperature. On reaching final conditions of the schedule and if 1 hour has not elapsed, temperature is raised 1° F. every 5 minutes to simulate the gradual approach toward static formation temperature. One hour after mixing the slurry is put in the filter press and pressured at the final consistometer temperature.

**TABLE 1**
**Low-Temperature Squeeze Slurries, API Class A Cements, 15.6 Lb. per Gal.**

| Formation temp., °F. | Per cent* SAC† | Per cent* calcium lignosulfonate |
|---|---|---|
| 80 to 110 | 1.2 | 0.3 |
| 110 to 155 | 1.3 | 0.4 |
| 155 to 200 | 1.4 | 0.4 |

*Based on weight of cement. †Sulfonated aromatic compound.

**TABLE 2**
**High-Temperature Squeeze Slurries, API Class E Cements, 16.2 Lb. per Gal.**

| Formation temp., °F. | Per cent* SAC† | Per cent* HTR‡ |
|---|---|---|
| 200 to 230 | 1.4 | 0.15 |
| 230 to 260 | 1.5 | 0.20 |
| 260 to 290 | 1.6 | 0.40 |
| 290 to 320 | 1.6 | 0.50 |

*Based on weight of cement. †Sulfonated aromatic compound. ‡High-temperature retarder.

For more severe test the procedure is repeated except filtration is measured 3 or 4 hours after mixing. This shows whether the additive is effective for the entire squeeze. Both tests are more stringent than standard API procedure.

**Slurry composition.** The material we currently use to control filtration is a sulfonated aromatic compound (SAC). We have also used a high-temperature retarder (HTR) in deep, hot wells. Slurries containing these materials have remained fluid for more than 3 hours in squeeze jobs at temperatures above 300° F. In shallow wells, we have used SAC and a compatible calcium lignosulfonate retarder. With these, we have got working times as long as 6 hours where temperatures only slightly exceeded those at the surface. At both temperature extremes, slurry dehydration has produced filter cakes with very high compressive strength in just a few hours while parent slurry remained a thin fluid.

At formation temperatures below 200° F. we find it possible to use API Class A cement with SAC and calcium lignosulfonate. Above that temperature, we use SAC and HTR in Class E cements with additions varying only slightly among the various brands. Table 1 lists our usual low-temperature mixtures and Table 2 shows an example of average additions in a Class E cement for high temperatures. A particular brand will probably deviate slightly from the average. These compositions have 30-minute filtrations of 50 to 55 cc. under a 1,000-lb. differential when tested on a 325-mesh screen at the temperature prevailing 1 hour after beginning a consistometer squeeze simulation. Fluid losses stabilize near these values almost as long as the slurry is fluid.

In the laboratory, we continually screen the various brands in both cement classes. Thus far no domestic Class E cements and only one Class A material have been found unsuited.


Coming up—special report on

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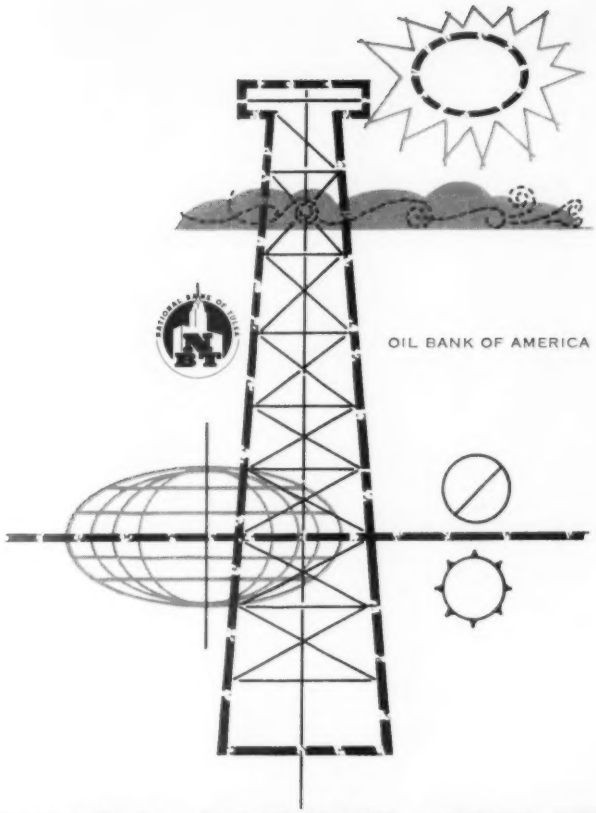
WATCH FOR The Oil and Gas Journal's special report on well logging in the June 12 issue.

Data from many sources on how to choose the right log will be available for the first time in a one-package, easy-to-read article.

A stimulating analysis on true-resistivity determination from conventional electric log has been prepared exclusively for this report.

An article on open-hole logging programs should be of interest to all who have drilled or will drill wells with air or gas in the hole, using rotary or cable tools.

Read these timely articles in the special well-logging report 2 weeks from now, June 12.

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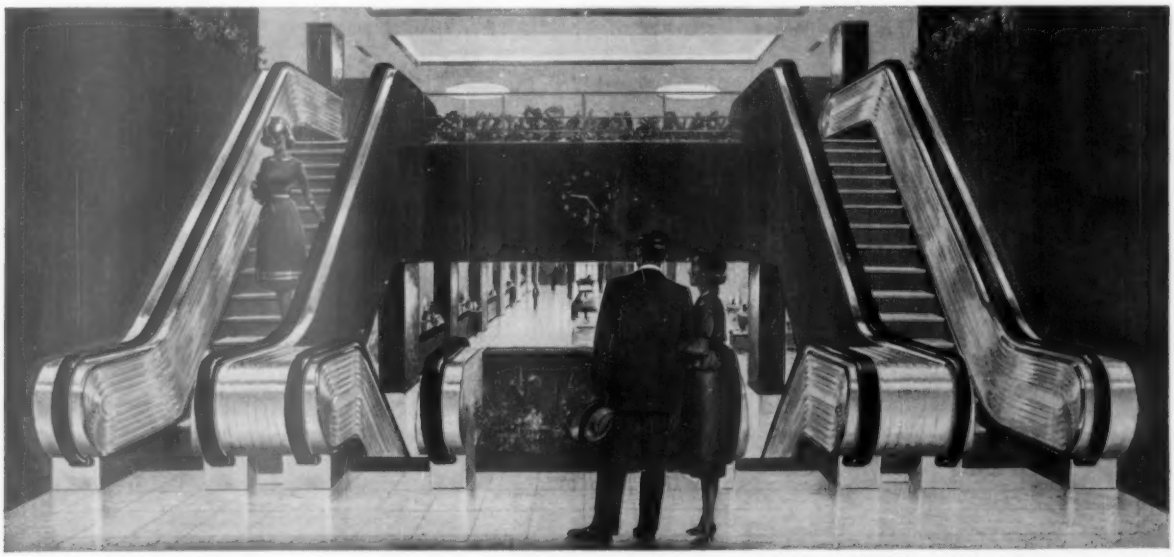

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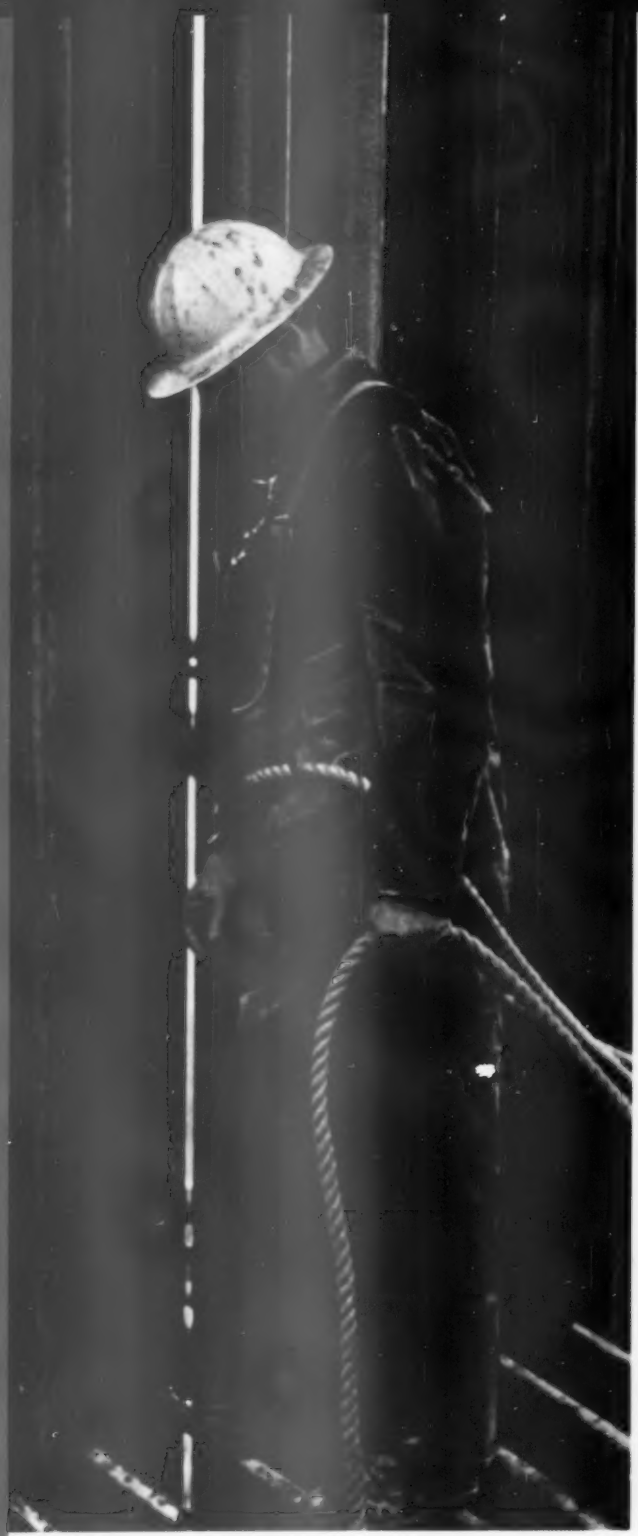

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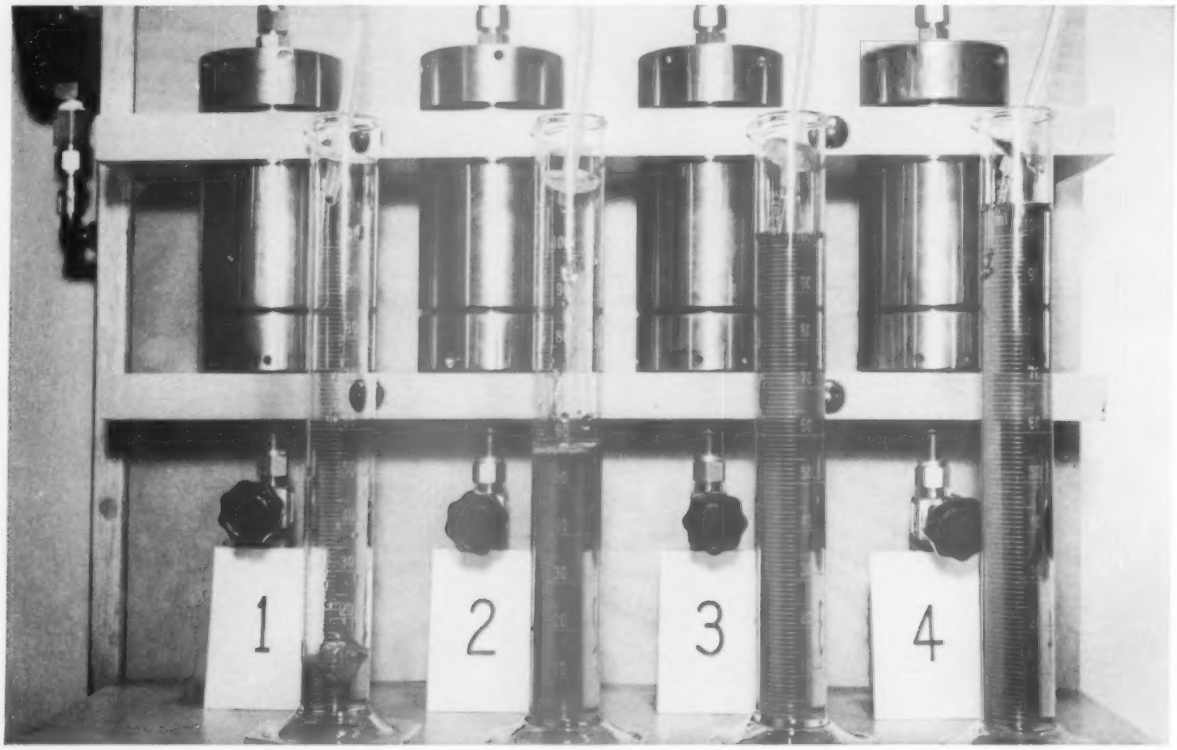
# fracture conductivity tests help you make more profit




*This Dowell-designed Fracture Conductivity Tester permits direct comparison of four different propping agents in a given formation. The rate of fluid flow indicates fracture conductivity. Note that the flow has only partly filled graduate 1 while the flow has passed the 100 ml mark in graduates 3 and 4.*

This is a Fracture Conductivity Tester – one of several types being used by Dowell. Over 1000 fracture conductivity tests have been made by Dowell to help design more effective fracturing treatments in a wide variety of formations.

If you have noticed that recent fracturing treatments have given greater production increases per dollar than usual, you are probably reaping rewards from these 1000 tests.

In using the tester shown, duplicate plugs are cut from a core taken from the well to be treated. These test plugs are split to simulate fractures, assembled in flexible sleeves and placed inside the cylinders shown.

Various propping agents are introduced into the "fractures" in the desired concentrations – either by hand or carried in stimulation fluid.

Overburden pressure is simulated by hydraulic pressure applied to the outside of the test plugs.

Treating fluids – with or without propping agents – are injected and left in the samples under pressure for 12 hours or more.

Conductivity of the "fracture" in each cylinder is then measured using either reservoir fluid or a special test fluid such as kerosene.

The results of these tests, plus other pertinent well data, are then interpreted through the Frac Guide* – Dowell's engineered plan for designing optimum fracturing treatments.

Ask your Dowell representative for a free copy of the new "Technical Report on Fracture Conductivity." This report deals with the important factors affecting the flow of fluids through fractures, such as size, type and amount of propping agent, formation hardness and overburden pressure.

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# FRINGE BENEFITS

## . . . Talk them up. Their real value depends on employe awareness of them

TWO MEN, both long-time employes of a gas company, called on me one day for help in setting up their own firm.

Practically all arrangements had been completed but one—they wanted their new company to have a program that would give them the same protection their present employer did.

I found that, because of their years of service, their salary, and their position, the company was providing benefits for them which would cost more than $240 a month to duplicate on an individual basis.

When they realized they would have to earn at least an additional $5,500 a year over their salaries and other costs of doing business to really break even, they dropped the idea and are still working for their local employer.

**Sell your plan.** The moral is plain: Their employer had an excellent insurance and retirement program. The employes knew it existed but did not fully appreciate its value.

By not keeping its employes fully and constantly aware of what it was providing, this company was on the verge of losing two valued men. It was missing out on the very purpose of its fine program of fringe benefits.

An enlightened company not only provides complete insurance coverage for its employes but, in its own interest, it keeps those employes informed of how that coverage affects them. One of the major objects of an insurance program is to build employe morale. Its effect on morale is directly proportional to the employes' awareness of the program.

BY ROBERT W. HAACKER

. . . president of Haacker & Associates, Inc., an insurance counseling firm in Shreveport, La., which represents many of the nation's top insurance companies. In 1958 he was "group leader of the year" for one of the top 10 in group insurance. Over the past 3 years alone he has written more than 100 group cases. Haacker earned his BS at Northern Illinois State and his MA at Iowa State, heads the Caddo-Bossier Association for Retarded Children and the Volunteers of America, taught in colleges and universities before going into insurance.

Every year companies spend millions of dollars on group insurance. A company that employs 500 people will spend at least $100,000 for a good group-insurance program.

**Possible saving.** Much of the total cost is paid by the company. Sometimes both this cost and the premium paid by employes can be reduced substantially.

Claims, reserves, retentions, and premiums on a group-insurance policy can be adjusted so that they will more closely measure the needs of a particular group. An analysis of claims paid may show what appears to be an excessive claims loss.

Excessive claims losses alarm insurance companies with the result that they charge higher premiums. If the excessive claims fall off, excessive claims reserves are built up. If they are not used they become profit for the insurance company and a loss to the insured.

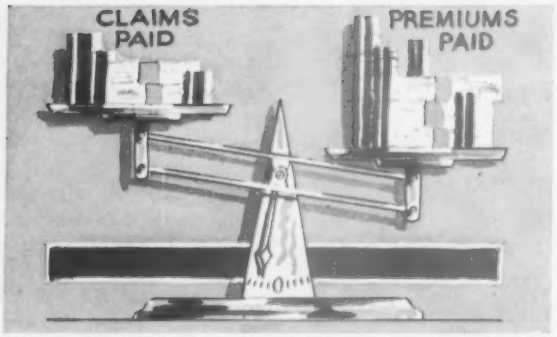
An analysis of employment practices, eligibility requirements, and the formula for the group-insurance program itself can initiate beneficial changes. Most insurance companies readily accept recommendations for changes if they are fully substantiated. If not, the insurance counselor who made the analysis will find one that will.

**Make it efficient.** The purchaser of group insurance is interested in making that phase of his operations as businesslike, efficient, and economical as any other. Here are some ideas which should be considered:

1. Many companies have subsidiaries or smaller companies which they own or control. If the group benefits of all companies were made uniform, combined, and placed with the same company, the added volume could warrant a discount. One large insurance company will discount 15% on life insurance, 16% on hospitalization, and 19% on disability if the annual premium is sufficiently large.

2. Some companies divide their program, placing their life insurance with one company and their hospital benefits with another. If both are combined with a single insurer, discounts may be obtained.

3. Older employes cost more. The monthly life rate per $1,000 of




**"An insurance company charges so much for a premium, pays back a portion in claims, and retains the balance as profit."**

insurance at age 30 is 22 cents in one company while the rate at age 60 is more than 10 times as much.

**Variable needs.** 4. Female employes also cost more. If 31% of a company's employes are female, its monthly premium rate may be 10% higher than a company having only 10% female content.

5. Everyone who goes to the doctor is not charged the same fee for the same service. An employe earning $15,000 per year will be charged more to have his appendix removed than one earning only $3,000. Thus, some need more protection than others. Group insurance can be arranged to pay different amounts in relation to the employe's income.

6. An insurance company charges so much for a premium, pays back a portion in claims, and retains the balance as profit. With large companies, the profit the insurance company makes can be controlled by using a retention formula. The insurer retains a specified portion of the premium (8-25%) for administration costs. Then the difference between the premium and the claims plus retention is returned to the policyholder as an experience-rated dividend.

**Policy misuse.** Frequently policies are misused by employes and the insured must pay for this loss. Misuse is generally either small, unnecessary claims or large claims in which the employe takes advantage of hospital services. A $25-$50 deductible clause or a coinsurance clause whereby the insurer pays 80% of the claim and insured 20% will greatly reduce such claims.

The theory of group insurance is for all to share the risk with the insurance company making a reasonable profit for its services. Therefore, claims paid are merely the return of premiums paid. If claims increase, premiums must also increase. And, if claims are reduced, premiums also should be reduced or refunded.

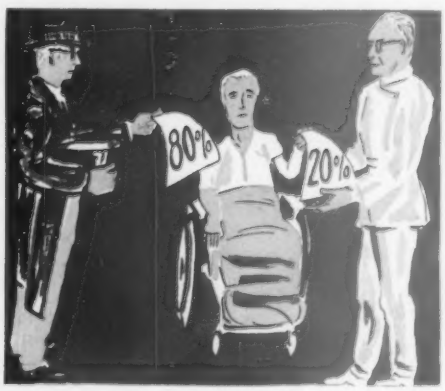
Every possible measure should be taken to keep claims to a minimum. Some companies require employes to take regular physical examinations, employ a nurse, have a first-aid station, distribute literature, provide lectures, show films, and use various types of visual aids to promote health and safety.

**Constant reminder.** Employes should be constantly reminded of the coverage made available to them through their employer. It is, in reality, additional income. Many insurance companies provide material for this purpose at no cost to the insured company.

Articles in house organs are helpful and so are bulletin-board materials. These, however, are general reminders. In those companies where the benefits increase with years of service, the company would make its position crystal clear if it gave each employe an annual personal statement on the insurance and retirement benefits he has earned.

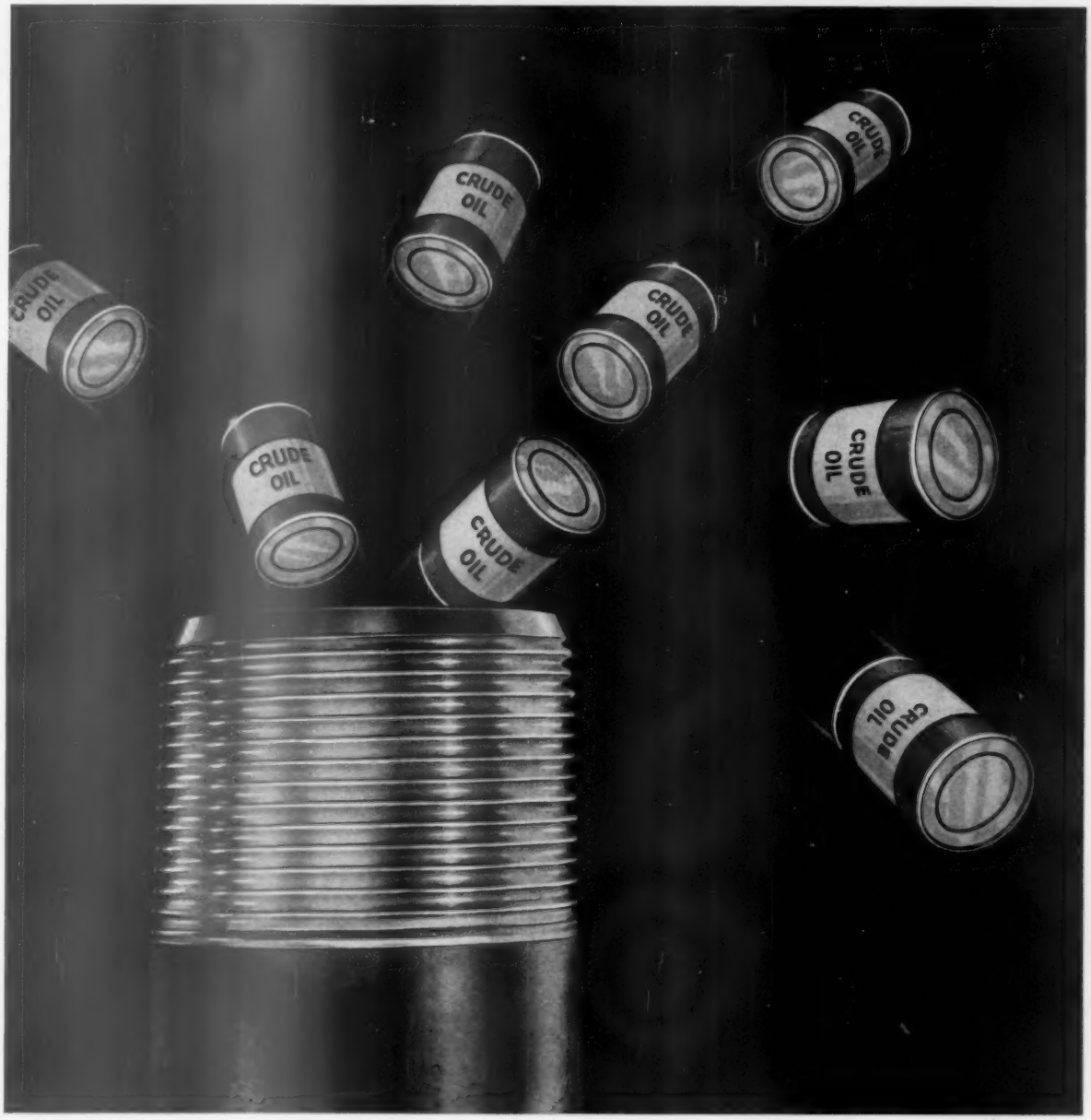
Are your company and its employes receiving the maximum cost? Some of these ideas may decrease costs and increase benefits.

Group insurance should be constantly measured, analyzed, and evaluated by the employer, the employe, and a qualified authority to provide the best program at the least cost.




**"A $25-$50 deductible clause, or coinsurance clause, whereby the insurer pays 80% of the claim and the insured 20%, greatly reduces claims."**

**"Bulletin-board materials and articles in house organs are helpful in reminding employes of coverage made available to them through the employer."**

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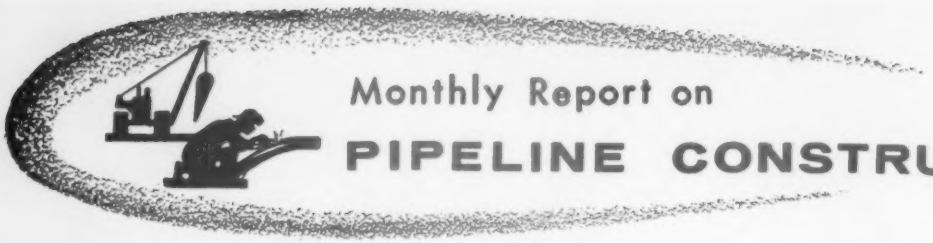

# Monthly Report on PIPELINE CONSTRUCTION

PIPELINE ACTIVITY reported here is compiled from surveys by The Oil and Gas Journal among pipeline companies and construction contractors.

This summary report appears in the last issue of the Journal each month. New construction projects are reported weekly in Pipeline Briefs in the Journal's new section.

Projects are listed in three groups—U. S., Canadian, and Foreign—and according to type of line—crude, products, natural gas, or miscellaneous.

★ The star symbol indicates the first appearance of the project in the Journal's survey.

## U. S. Crude Oil Pipelines

**BELL OIL & GAS CORP.**, Tulsa.
Project: 12-mile, 8-in. crude oil line from Hewitt to Ardmore, Okla.
Completion: July 1, 1961.

**CONTINENTAL PIPE LINE CO.**, Drawer 1267, Ponca City, Okla.
Project: 4 miles of 3-in., 18 of 4-in., 68 of 6-in., 323 of 8-in., and 53 of 10-in., in new Glacier Pipe Line System from Cutbank, Mont., to Byron, Wyo.
Status: Under way.
Contractor: R. H. Fulton & Co., Lubbock, Tex.
Completion: July 5, 1961.
Project: 20.7 mile, 8-in. crude line from Grand Isle to Golden Meadow, La.
Completion: December 31, 1961.
Contractor: Glaser Construction Co.

**GILLETTE PIPELINE, INC.**, and **A. W. HARTWIG, INC.**
Project: A 102-mile line from Dead Horse Creek field to Casper, Wyo.
Status: Pending Wyoming Public Service Commission approval.

**GREAT NORTHERN PIPE LINE CO.**, 175 East 4th St., St. Paul 1, Minn.
Project: 64-mile extension of system northwestward to the Lignite field, Burke County, North Dakota.
Status: Planned for 1961.

**LAFITTE OIL TRADERS, INC.**, Bartlesville, Okla.
Project: 9-mile, 4-in. Grand Coulee gathering system, Acadia Parish, Louisiana.
Completion: June 1961.

**MATADOR PIPE LINE CORP.**, Denver, Colo.
Project: 175-mile line from Burke, Bottineau, and Renville counties, North Dakota, to Cromer, Man.
Status: Pending approval of Canadian National Energy Board.

**MESA PIPELINE CO.**, Midland, Tex.
Project: Extension of gathering system to other fields in West Texas and southeastern New Mexico.
Status: Planned.

**MID-AMERICA PIPELINE CO.**, Skelly Building, Tulsa.
Project: 405-mile, 10-in. condensate line from Superior, Wis., to Chicago. It would connect at Superior with the trunk line of Lakehead Pipe Line Co., eastern division of Interprovincial Pipe Line Co. Shipments would be fed into Interprovincial from gathering lines now under consideration in Alberta.
Status: Proposed.

**MID-CONTINENT PIPE LINE CO.**, Tulsa.
Project: 9-mile, 6-in. crude oil line from Crider field to Maysville station, Okla.
Status: Planned.

**NORTHWESTERN REFINING CO.**, Box 248, St. Paul Park, Minn.
Project: 4, 6, and 8-in. gathering lines in Glenburn field, Renville and Bottineau counties, North Dakota.
Status: Has state approval.

**OVERLAND PIPELINE INC.**, Wichita, Kans.
Project: 4-in. gathering system in Lone Tree field, Wyo., and transmission line to connect with Plains Pipeline Division of Franklin County Coal Corp.
Status: Application before Wyoming PSC.

**PHILLIPS PIPE LINE CO.**, Bartlesville, Okla.
Project: Line from Beaver County, Oklahoma, to Borger, Tex. 26.75 miles, 12-in.; 10.5 miles, 8-in.; 30 miles, 6-in.; 47 miles, 4½-in.; 3 miles, 3-in.
Status: Design stage.
Completion: July 1, 1961.
★ Project: 31.6 miles, 8-12-in. from Borger to Spearman.
Contractor: Groninger & King, Inc.
Completion: May 30.

**SERVICE PIPE LINE CO.**, Tulsa.
Project: 60-mile, 12-in. crude line, La Plata, Mo., to Wood River, Ill.
Contractor: River Construction Co.
Completion: June 1, 1961.

**SINCLAIR PIPE LINE CO.**, Independence, Kans.
Project: 170-mile, 8-in. from Northwest Oklahoma to Sinclair main line in eastern Oklahoma.
Status: Underway.

**TETON PIPE LINE CORP.**, 1700 Broadway, Denver 2, Colo.
Project: 45 miles of 6-in. gathering and transmission line in Dead Horse Creek, Barber Creek, and Sussex fields in Campbell and Johnson counties, Wyoming, to connect with Service Pipe Line Co. facilities at Sussex.
Status: Approved by Wyoming Public Service Commission.

## U. S. Products Pipelines

**BUCKEYE PIPE LINE CO.**, 30 Broad St., New York 4.
Project: 42 mile 8-in. extension of Midwest products system from Flint to Bay City, Mich.
Status: To start spring 1961.

**CARL M. LOEB, RHOADES & CO.**, 42 Wall St., New York 5.
Project: 75-mile, 20-in. line from New Jersey refineries to Long Island and its two big airports, Idlewild and La Guardia.
Status: Study being made by Gulf Interstate Co., Houston, Tex.

**DIXIE LPG PIPE LINE CO.**, (organized by Warren Petroleum Corp., Phillips Petroleum Co., Union Texas Natural Gas Co., and Tuloma Gas Products Co.), 800 Enterprise Building, Tulsa.
Project: 1,100-mile, 8 to 10-in. propane line from the Houston area to Raleigh, N. C.
Status: Service Pipe Line Co., Tulsa, design and construction agent.
Completion: Fall 1961.

**EL PASO NATURAL GAS CO.**, El Paso, Tex.
Project: 58-mile, 6 in. LPG line from Jal, N. M., extraction plant to El Paso Natural Gas Products Co. refinery at Odessa, Tex.
Status: Planned.

**GREAT LAKES PIPE LINE CO.**, Kansas City, Mo.
Project: Conversion of 6-in. products lines from Des Moines, Iowa, to Minneapolis and to Chicago area to tie-in with Northern Gas Products LPG line from Bushton, Kans.
Status: Planned.

**HUMBLE PIPE LINE CO.**, Box 2220, Houston, Tex.
Project: 11 miles of 4-in. LPG line from Baytown to Mont Belvieu, Tex.
Status: Underway.
Completion: June 1961.
Project: 6.6 mile, 4-in. products line from Irving to Amon Carter field.
Status: Planned.
Completion: September, 1961.

**INTERPROVINCIAL PIPE LINE CO.**, Toronto, Ont., Canada.
Project: 400-mile, 10-in. line from Superior, Wis., to Chicago area to deliver Alberta condensate via Interprovincial-Lakehead system.
Status: Proposed.

**MID-AMERICA PIPELINE CO.**, Tulsa.
Project: 106-mile, 6-in. extension of LPG system from Whiting to Ogden, Iowa.
Status: Acquiring right-of-way.
Construction: To begin this summer, complete this fall.
Project: 100-mile extension from Ogden to Charles City, Iowa.
Status: Planned.
Construction: Planned for 1962.

**NORTHERN GAS PRODUCTS CO.**, Omaha, Neb.
Project: 350-mile, 8-in. LPG line from Bushton, Kans., extraction plant to Des Moines, Iowa, where it will connect with Great Lakes 6-in. lines to Twin Cities and to Chicago area.
Status: Planned.

**SOUTHERN PACIFIC PIPE LINES, INC.**, 65 Market St., San Francisco, Calif.
Project: 70-mile 8-in. jet-fuel line from Stockton to Castle Air Force Base near Atwater, Calif.
Contractor: Eastern Pipeline Contractors, Dallas.

**TEXAS EASTERN TRANSMISSION CORP.**, Box 1189, Houston 1, Tex.
Project: 290-mile LPG line between South Louisiana and Mont Belvieu, Tex.
Status: Planned.

**TRANS-SOUTHERN PIPELINE CORP.**, (subsidiary of Transcontinental Gas Pipe Line Corp., Box 296, Houston).

## PIPELINE CONSTRUCTION

Project: 1,000 miles of 8 to 12-in. LPG line from Mont Belvieu, southeast of Houston, to Sanford, N. C.
Status: Three crossings completed.

**WEST SHORE PIPELINE CO.**, Des Plaines, Ill.
Project: 285-mile products line from East Chicago refineries to Green Bay, Wis. The line will be 16-in. from East Chicago to Milwaukee and 10-in. from Milwaukee to Green Bay. A 16-in. lateral will connect line with company terminals at Jones Island.
Status: Construction will begin in June.
Completion: Scheduled before Dec. 31.

**YELLOWSTONE PIPE LINE CO.**, Ponca City, Okla.
Project: 82-mile, 6-in. products line from Helena to Great Falls, Mont.
Completion: Dec. 1, 1961.
Contractor: R. H. Fulton & Co.

## U. S. Natural Gas Pipelines

**ALABAMA-TENNESSEE NATURAL GAS CO.**, Box 380, Florence, Ala.
Project: 3½-mile, 6-in. line to serve Armour Agricultural Chemical in Colbert County, Alabama.
Status: Planned.

**ALAMO GAS SUPPLY CO.**, Alamo National Building, San Antonio, Tex.
Project: 166 miles of 20, 22, and 24-in. line and 101 miles of 12, 16, and 24-in. line from Texas Gulf Coast to San Antonio.

**ALASKA PIPE LINE CO.**, Houston, Tex.
Project: 74 miles from Kenai Unit gas field to Anchorage.
Status: Construction suspended until spring 1961.
Project: Extension of Kenai-Anchorage line to Fairbanks.
Status: Alaska Pipe Line Co. has ordered feasibility studies.

**ALGONQUIN GAS TRANSMISSION CO.**, 25 Faneuil Hall Square, Boston 9, Mass.
Project: 30 miles of line in Massachusetts.
Status: Approved by FPC.

**AMERICAN LOUISIANA PIPE LINE CO.**, Detroit, Mich.
Project: 25-mile, 8-in. to connect Holly Ridge field, Tensas Parish, Louisiana, to main line.
Status: Pending FPC approval.

**ARKANSAS WESTERN GAS CO.**, Box 405, Fayetteville, Ark.
Project: New lines from Altus, Coal Hill, and Rock Creek fields to the main system.
Status: Approved by Arkansas Public Service Commission.

**BORDER GAS TRANSMISSION CORP.** (owned by Lehman Brothers, New York investment firm, and Rio Gas Gathering Co., 615 National Bank of Commerce Building, San Antonio 5, Tex.).
Project: Gathering lines in Starr, Zapata, Jim Hogg, Brooks, and Webb counties, Texas.
Status: Proposed.
Project: Gathering lines in Dimmit, Zavala and La Salle counties, Texas.
Status: Proposed.

**CITIES SERVICE GAS CO.**, Box 1995, Oklahoma City 1, Okla.
Project: 10½ miles of 8-in. to connect Rounds and Porter plant with main line in Marion County, Kansas.
Status: Planned.
Project: Gathering lines in Sterling field, Comanche County, Oklahoma.
Status: Pending FPC approval.

**COASTAL TRANSMISSION CO.**, Houston, Tex.
Project: 71 miles of various size laterals in Florida.
Status: Approved by FPC examiner.

**COLORADO GAS TRANSMISSION CO.**, Colorado Springs, Colo.
Project: 20-inch natural gas line, approximately 250 miles, from Ignacio-Blanco area, Southwest Colorado, to Walsenburg, Pueblo and Colorado Springs, Colo.
Status: Application before Colorado PUC.

**COLORADO INTERSTATE GAS CO.**, Box 1087, Colorado Springs, Colo.
Project: 7 miles of 20-in. in Texas Panhandle.
Status: Pending FPC approval.
Completion: 1961.
Project: 109 miles of 26-in. from Texas Panhandle to southeastern Colorado; 134 miles of 34-in. from there to Pueblo, and 107 miles of 30-in. on to Denver.
Completion: 1961.
Project: 155 miles of 34-in. from Rock Springs, Wyo., to Provo, Utah, to connect with El Paso's proposed 395-mile line to California.
Status: Approved by FPC.
Completion: 1963.
Project: 32 miles of 6-in. from Central Colorado to Trinidad.
Status: Pending FPC approval.

**COLORADO OIL & GAS CORP.**, Denver, Colo.
Project: 402-mile line from Gubik field to Fairbanks, Alaska.
Status: Proposed.

**COLORADO-WYOMING GAS CO.**, Box 480, Denver 1, Colo.
Project: 16½-mile, 16-in. transmission line in Adams and Boulder counties, Colorado.
Status: Pending FPC approval.
Project: 2-mile, 4-in. gas line from mainline system to Niwot, Colo.
Status: Planned.

**COLUMBIA GAS SYSTEM, INC.**, 120 East 41 St., New York 17.
Projects: Eight loops totaling 96.9 miles, 30-in. in Kentucky, Tennessee, Mississippi and Louisiana, plus 29 miles of 12-in. gathering line from near Houma, La., to the Texaco Dog Lake field.
Status: Planned.
Completion: 1961.

**COLUMBIA GULF TRANSMISSION CO.**, Box 683, Houston 1, Tex.
Project: 9½ miles, 10-in. gathering line, Marguerite to Ivanhoe, La.
Status: Underway.
Project: 0.9 mile, 6-in. gathering line in Terrebonne Parish, Louisiana.
Status: Under way.
Project: 97 miles of main-line loop in Kentucky, Tennessee, Mississippi, and Louisiana, and 29 miles of 12-in. lateral supply lines in Louisiana.
Status: Pending FPC approval.
Completion: 1961.

**EAST TENNESSEE NATURAL GAS CO.**, Knoxville, Tenn.
Project: Carthage laterals 10.1 miles, 4-in. to South Carthage, Tenn., and Monterey lateral, 13.4 miles, 6-in. to Pleasant Hill, Tenn.
Status: Planned.

**EL PASO GAS SUPPLY CO.** (subsidiary of El Paso Natural Gas Co., Box 1492, El Paso).
Project: 228 mile, 30-in. line from Live Oak County to Sonora in Sutton County.
Status: Pending FPC approval.

**EL PASO NATURAL GAS CO.**, Box 1492, El Paso, Tex.
★ Project: 61.3-mile, 10¾-in. lateral to Bremerton, Wash., to be extended 75 miles to Port Angeles by Natural Gas Transmission Co., El Paso subsidiary.
Status: Before FPC.
Project: 52 miles of 20-in. transmission from new plant in Terrell County to a line connection in Pecos County, Texas, plus 23 miles of various-size field line.
Status: Approved by FPC.
Project: 119 miles of 30-in. Permian-San Juan crossover loop.
Status: Pending FPC approval.
Completion: 1961.
Project: 17 miles of 30-in. near Spokane, Wash.
Status: Pending FPC approval.
Completion: Not known.
Project: 34 miles of 20-in. from Puckett tie-in to Goldsmith, Tex.
Status: Pending FPC approval.
Completion: 1961.
Project: 23 miles of 20-in. from Goldsmith to the Eunice-Plains line, and 395 miles of 34-in. from Thistle, Utah, to near Las Vegas, Nev.
Completion: 1961.
Project: Loop on the San Juan mainline, involving 27½ miles of 34-in.
Status: Pending FPC approval.
Completion: Not known.
Project: About 228 miles of 30-in. from Coquat to Sonora, Tex.
Status: Pending FPC approval.
Completion: Not known.

**EQUITABLE GAS CO.**, 420 Boulevard of the Allies, Pittsburgh, Pa.
Project: 15 miles of 16-in. in Monongalia County, West Virginia, and Greene County, Pennsylvania.
Status: Approved by FPC.
Completion: July 1961.
Project: 6 miles of 20-in. in Greene County, Pennsylvania.
Status: Approved by FPC.
Completion: July 1961.
Project: 17 miles of 20-in. in Greene and Washington counties, Pennsylvania.
Status: Approved by FPC.
Completion: October 1962.

**HOUSTON TEXAS GAS & OIL CORP.**, Box 10400, St. Petersburg 33, Fla.
★ Project: 16-mile, 14-in. lateral to Tennessee Corp. plant near St. Petersburg, Fla.
Contractor: Burnup & Sims.
Completion: June 1, 1961.
Project: 235 miles of various size laterals in Florida.
Status: Approved by FPC examiner.

**KANSAS-NEBRASKA NATURAL GAS CO., INC.**, Hastings, Neb.
Project: 6.3-mile, 8-in. gas line to serve coop fertilizer plant at Hastings, Neb.
Status: Approved by FPC.
Completion: Sept. 1, 1961.
Project: 24.5 miles, 8-in. gas line from Huntsman to Northport, Neb.
Status: Approved by FPC.
Completion: Oct. 1, 1961.

**KENTUCKY-WEST VIRGINIA GAS CO.**, Pittsburgh, Pa.
Project: 9.8-mile, 8-in. gathering system, Knott County, Kentucky.
Completion: By June 30, 1961.

**LONE STAR GAS CO.**, 301 South Harwood St., Dallas 1, Tex.
Project: 14½-mile, 8-in. connection of the company's system to Pure Oil's gasoline plant in Caddo field, Oklahoma.
Status: Planned.
Project: 51.2 miles, 18-in. gas line from Parker County to Palo Pinto County, Texas.
Status: Under way.
Completion: Before June 30, 1961.
Project: Gathering lines, 6.3 miles, 16-in. in Bratch County, 16.5 miles of 8-in. and 11.6 miles of 6-in. in Palo Pinto County, 23.3 miles of 8-in. in King County and 7.6 miles of 8-in. in Smith County, Texas, and 14.5 miles, 8-in. in Oklahoma.
Status: Under way.

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Completion: Before June 30, 1961.

**LO-VACA GATHERING CO.** (see parent company, Coastal States Gas Producing Co.).

**MANUFACTURERS LIGHT & HEAT CO.,** Union Trust Building, Pittsburgh 19, Pa.
Project: 10½ miles of 24-in. Washington and Beaver counties, Pennsylvania.
Status: Planned.
Completion: September 1961.

**MICHIGAN WISCONSIN PIPE LINE CO.,** 500 Griswold St., Detroit, Mich.
Project: 64.5 miles, 4/10-in. Laverne field gathering lines.
Status: Planned.
Completion: Gradually over 1961.
Project: 97 miles, 16/20-in. gas line from Woodward, Okla., area to Greensburg, Kans., compressor station.
Status: Before FPC.
Project: 68 miles, 4/10-in. gathering system, Woodward, Okla., area.
Status: Before FPC.
Project: 26 miles, 30-in. loop in Michigan, 10 miles, 12-in. loop in Wisconsin.
Status: Pending FPC approval.
Project: 48 miles, 10-in. Madison lateral to Baraboo, Wis.
Status: Pending FPC approval.

**MISSISSIPPI RIVER FUEL CORP.,** 407 North 8th Street, St. Louis 1, Mo.
Project: 5 miles of 16-in. and 15 miles of 12-in. from Collinsville, Ill., to St. Jacob, Ill.
Status: Pending FPC approval.

**MONTANA-DAKOTA UTILITIES CO.,** Minneapolis, Minn.
Project: 106-mile, 12-in. natural gas line from Minot, N. D., to Bismarck.
Status: Before FPC.
Completion: September 1, 1961.

**MONTANA POWER CO.,** Box 1338, Butte, Mont.
Project: 16-in. line from Carway, Alta., to Cut Bank, Mont.
Completion: 1961.

**MOUNTAIN FUEL SUPPLY CO.,** Salt Lake City, Utah.
Project: 94.3-mile, 20-in. gas line with Natural Gas Co. from Uinta basin to near Provo, Utah.
Status: Planned.

**MUSTANG FUEL CORP.,** Oklahoma City, Okla.
Project: 75 miles, 4½ through 12¾ in. between Piedmont and Oakwood, Okla.
Completion: June 1961.
Project: 17 miles, 10¾-in. through 12¾-in. from Newcastle to Crider, Okla.
Completion: June 1961.

**NATURAL GAS PIPELINE CO. OF AMERICA,** 122 South Michigan Avenue, Chicago.
Project: 50 miles of 20-in. laterals and 4.5 miles of 6-in. laterals to connect with existing 26-in. system in Jim Wells County, Texas, plus 33 miles of 10-in. laterals in the Normanna area.
Status: Temporary FPC approval.
Project: 285 miles, 30-in. and 60 miles, 36-in. loops and 22.5 miles, 8-in. laterals between Texas and Illinois.
Status: Pending FPC approval.
Completion: 1961.

**NORTHERN NATURAL GAS CO.,** 2223 Dodge St., Omaha 1, Neb.
★ Project: 65-mile, 16-in. line from Duluth to Reserve Mining, Minn.
Contractor: Curran & Co.
Completion: Aug. 1, 1961.
Project: 11.5 miles, 30-in.; 62.7 miles, 16-in. and 1.2 miles, 4-in. to serve towns of Silver Bay and Two Harbors, Mich., and Reserve Mining Co., Silver Bay.
Status: Conditionally approved by FPC.
Projects: 1,100 miles of laterals:
116 miles, 2-8 in. to 20 Minnesota towns.
Contractor: Davis Construction Co.
136 miles, 2-8 in. to 26 Minnesota towns.
Contractor: Harbert Construction Co.
426 miles, 2-19 in. to 62 Iowa towns.
Contractor: R. H. Fulton & Co.
130 miles, 2-8 in. to 25 Iowa and Nebraska towns.
Contractor: Shamrock Construction Co.
176 miles, 2-8 in. to 29 Iowa, Nebraska, South Dakota towns.
Contractor: Brodie Construction Co.
116 miles, 2-8 in. to 15 Minnesota, South Dakota towns.
Contractor: R. E. Reutzel Co.
Status: Approved by FPC.
Completion: September 1, 1961.

**OHIO FUEL GAS CO.,** Columbus, Ohio.
Project: 24.6 miles replacement program, 5.7 miles, 12-in. to Medina and Lorain counties, 4.5 miles, 12-in. near Zanesville, 8.4 miles, 12-in. in Holmes, Tuscarawas, Carroll and Stark counties, 1 mile, 8-in. in Madison County and 2.5 miles, 18-in. in Meigs, Athens and Hocking counties, Ohio.
Status: Planned.

**PACIFIC GAS & ELECTRIC CO.,** 245 Market St., San Francisco, Calif.
Project: 67 miles of line from Kettleman Hills to Morro Bay, Calif.
Project: 120 miles of 34-in. looping of Topock-Milpitas main line.
Status: Planned. Pending FPC approval.
Completion: 1963.
Project: 291 miles of 36-in. from the California-Oregon border to Antioch, Calif. (Part of a 1,400-mile project to move Alberta gas to San Francisco.)
Contractor: H. C. Price Co., Bartlesville, Okla. (Bechtel Corp. San Francisco, is the engineering manager.)
Status: Under way.
Completion: Dec., 1961.

**PACIFIC GAS TRANSMISSION CO.,** (Pacific Gas & Electric Co., San Francisco).
Project: 611 miles of 36-in. from the Canadian border at Eastport, Idaho, to the California border near Klammath Falls, Ore. (Part of a 1,400-mile project to move Alberta gas to San Francisco.)
Contractors: Western Pipe Line, Inc., Austin, Tex., and J. P. Neill & Co., Dallas, have contracts for the 465-mile southern portion. H. C. Price Co., Bartlesville, Okla., has contract for the 146-mile northern portion from Rosalia, Wash., to Eastport, Idaho. (Bechtel Corp., San Francisco, is the engineering manager.)
Status: Under way.
Completion: Dec., 1961.

**PACIFIC LIGHTING GAS SUPPLY CO.,** Los Angeles, Calif.
Project: 24-mile, 16-in. gas line from Gaviota to Goleta, Calif.
Completion: August 1961.

**PANHANDLE EASTERN PIPE LINE CO.,** 120 Broadway, New York.
Project: Gathering lines, 3.85 miles of 4-in. and 3.44 miles of 6-in. in Oklahoma and 1.87 miles of 4-in. and 1.01 miles of 6-in. in Kansas.
Project: 298 miles of 30-in. loops, 43 miles of 16 to 26-in. supply laterals, and 80 miles of 6 to 12-in. sales laterals.
Status: Pending FPC approval.

**PEOPLES NATURAL GAS CO.,** Pittsburgh, Pa.
Project: 15.25 miles, 8 to 20-in., Allegheny and Westmoreland counties, Pennsylvania.
Status: Planned.
Completion: June-August 1961.

**PHILLIPS PETROLEUM CO.,** Bartlesville, Okla.
Project: 16 miles of 2 to 8-in. gathering line in Eddy County, New Mexico.
Status: Planned.
Project: 17 miles of 4 to 10-in. gathering line in Midland County, Texas.
Status: Planned.

**PIONEER NATURAL GAS CO.,** Amarillo, Tex.
Project: 21 miles of 12-in. from Sudan to Muleshoe, Tex.
Status: Pending FPC approval.
Project: 12 miles of 10-in. from Muleshoe, Tex., northward.
Status: Pending FPC approval.

**PIPELINE TECHNOLOGISTS, INC.,** Houston, Tex.
Project: 50 miles various size lines, gas gathering system, Marion County, Kansas.
Completion: September 1961.

**RIO GRANDE VALLEY GAS CO.,** Brownsville, Tex.
★ Project: 50-mile, ¾-8-in. system to supply irrigation pumps along Rio Grande River near Las Cruces, N. M.

**SOUTHERN CALIFORNIA GAS CO.,** and **SOUTHERN COUNTIES GAS CO. OF CALIFORNIA,** Los Angeles, Calif.
Project: 150-mile line across southern California from the Nevada border to the Los Angeles basin. Line would connect with a proposed El Paso Natural Gas Co. line extending to Rock Springs, Wyo.
Status: Pending PUC approval.

**SOUTHERN NATURAL GAS CO.,** Birmingham, Ala.
Project: 14.4 miles, 20-in. gas line from Gwinville field to Pickens station.
Status: Pending FPC approval.
Completion: Dec. 31, 1961.

**SOUTHERN UNION GAS CO.,** Fidelity Union Tower, Dallas 1, and **EL PASO NATURAL GAS CO.,** Box 1492, El Paso, Tex.
Project: 60-mile line from El Paso's main line near Holbrook, Ariz., to paper mill under construction near Snowflake.
Status: Planned.

**SOUTHERN UNION GAS CO.,** Dallas, Tex.
Project: 22.6 mile, 8⅝-in. line connecting transmission line near Holbrook, Ariz., to point 15 miles west of Snowflake.
Completion: Aug. 1961.
Project: 7.2 mile, 16-in. line from Santa Junction to Alameda, N. M.
Completion: Aug. 1961.
Contractor: Mermis Construction Co.
Project: 5 mile, 8⅝-in. line from Southwestern Public Service Cunningham station to Lovington, N. M.
Completion: July 1961.

**ST. LAWRENCE GAS CO.,** Ogdensburg, N. Y.
Project: 75 miles of line from Cornwall, Ont., to Ogdensburg, N. Y.
Status: Approved by FPC.

**TENNESSEE-CALIFORNIA GAS TRANSMISSION CO.,** Box 2511, Houston, Tex.
Project: 105-mile, 26-in. line from Humble's King Ranch via Kleberg, Brooks and Hidalgo counties to Mexican border to connect with Tennessee-Pemex line to California. Included are 69 miles of 12-in. and smaller laterals.
Status: Pending FPC decision.

**TENNESSEE GAS PIPELINE CO.,** a division of Tennessee Gas Transmission Co., Box 2511, Houston 1, Tex.
Contractor: Houston Contracting Co.
Project: 16.8 miles, 12-in. gathering lines, offshore Louisiana.
Status: Approved by FPC.
Project: 12.4 miles, 12-in. gathering lines, offshore Louisiana.
Status: Approved by FPC.
Project: 9.8 miles, 10-in. gathering lines,

## PIPELINE CONSTRUCTION

offshore Louisiana.
Status: Pending FPC approval.
Project: 20.6 miles, 12-in. gathering lines, offshore Louisiana.
Status: Pending FPC approval.
Project: 13 miles, 20-in. gathering lines, offshore Louisiana.
Status: Pending FPC approval.
Project: 6.4 miles, 12-in. gathering lines, offshore Louisiana.
Status: Pending FPC approval.
Project: 15 miles of 12-in. gathering line offshore Louisiana.
Status: Pending FPC approval.
Project: 11½ miles of 16-in. offshore Louisiana.
Status: Pending FPC approval.
Project: 158 miles of 36-in. loop lines at various points between Kinder, La., and Centerville, Tenn.
Status: Approved by FPC.
Project: 166 miles of 36 and 30-in. loop lines at various points in Ohio and Pennsylvania.
Status: Pending FPC approval.

**TENNESSEE GAS TRANSMISSION CO.,** Box 2511, Houston, Tex.
Project: 1,100-mile, 30-in. line Texas to California through Mexico (see Foreign Natural Gas listing).
Project: 292-mile line from the California-Mexican border to Los Angeles to tie in with above-mentioned line.
Status: Tennessee Gas' subsidiary, California Gas Transmission Co., and Southern California Edison Co. have applied to California PUC. Also pending FPC approval.
Project: A line from King Ranch, Texas, to the Mexican border, to connect with proposed line through Mexico to California.
Status: Tennessee Gas subsidiary, Tennessee California Gas Transmission Co., to build and operate the Texas segment.

**TEXAS EASTERN TRANSMISSION CORP.,** Box 1189, Houston 1, Tex.
Projects: 165 miles of 20-in. from West Monroe, La., to Kosciusko, Miss.
Status: Planned, filed with FPC.
Completion: 1961.
Project: 40 miles, 36-in., Station 26 to Station 27, N. J.
Status: Planned, authorized.
Completion: 1961.
Project: 89 miles, 30-in. Kosciusko station, Miss., and Station 21-A, Pa.
Status: Planned, filed with FPC.
Completion: 1961.
Project: 40 miles, 30-in. Delmont station, Pa., to Station 26, N. J.
Status: Planned, filed with FPC.
Completion: 1961.
Project: 45 miles, 30-in. Delmont station, Pa., to Station 26, N. J.
Status: Planned, filed with FPC.
Completion: 1962.
Project: 42 miles, 30-in., Kosciusko station, Miss., to Station 21-A, Pa.
Status: Planned, filed with FPC.
Completion: 1962.
Project: 57 miles, 14-in., Castor, La., to West Monroe, La.
Status: Planned, filed with FPC.
Completion: 1961.
Project: 13 miles, 14-in. Middlesex County, to Barnardsville, N. J.
Status: Planned, filed with FPC.
Completion: 1962.
Project: 14 miles, 12 in., Barnardsville to Roseland, N. J.
Status: Planned, filed with FPC.
Completion: 1961.
Project: 11 miles, 10 in., Middlesex County to Helvetta, N. J.
Status: Planned, filed with FPC.
Completion: 1961.

**TEXAS GAS TRANSMISSION CORP.,** Box 577, Owensboro, Ky.
Projects: 146 miles of new line including 6, 26, and 30-in. loops in Kentucky, Tennessee, Mississippi, Louisiana, and Indiana, and 50 miles of 8 and 16-in. to connect five fields in Terrebonne Parish, Louisiana.

**TRANSCONTINENTAL GAS PIPE LINE CORP.,** 3100 Travis St., Houston, Tex.
Project: 15 miles of 36-in. main-line loop to bypass reservoir of Cowan's Ford hydroelectric project on North Carolina's Catawba River.
Project: 25 miles, 30-in. in Texas, 24 miles, 36-in. in Louisiana; 58 miles, 36-in. in Mississippi; 75 miles, 36-in. in Alabama; 91 miles, 36-in. in Georgia, main line loops.
Status: Pending FPC approval.
Completion: 1961.
Project: 57 miles, 36-in. in South Carolina; 14 miles, 36-in. in North Carolina; 23 miles, 36-in. in Virginia and 23 miles, 36-in. in Maryland, main line loops.
Status: Pending FPC approval.
Project: 37 miles, 3-8-in., Southeast Louisi-
Project: 37 miles, ⅜-in., Southeast Louisiana offshore.
Status: Pending FPC approval.
Completion: 1961 or 1962.

**TRANSWESTERN PIPELINE CO.,** 618 First City National Bank Building, Houston 2, Tex.
Project: Gathering system in West Texas and Panhandle areas, 6 miles, 12-in.; 7 miles, 10-in.; 20 miles, 8-in.; 125 miles, 6-in.; 195 miles, 4-in.
Status: Under way.
Completion: December 1961.
Contractor: Sheehan Pipe Line Construction Co.

**TRUNKLINE GAS CO.,** Box 1642, Houston, Tex.
★ Project: 21-mile, 30-in. line from LaCenter to Columbus, Ky.
Contractor: Western Pipe Line, Inc.
Completion: June 10, 1961.
★ Project 21-mile, 30-in. line from New Dennison, to Vienna, Ill.
Contractor: Western Pipe Line, Inc.
Completion: June 20, 1961.
★ Project: 21-mile, 30-in. line north of Deridder, La.
Contractor: Panama, Inc.
Completion: Late spring, 1961.
★ Project: 21.4 mile, 30-in. line from Vienna to Marion, Ill.
Completion: 1961.
★ Project: 21-mile, 30-in. line from Dry Creek to Pitkin, La.
Completion: 1961.
Project: 76 miles, 26-in. from Longville to Cow Island, La.
Completion: 1961.
Project: 52 miles of 20-in. from Bayou Sale to Cow Island, La.
Completion: 1961.

**UNITED GAS PIPE LINE CO.,** Box 1407, Shreveport 92, La.
Project: 217 miles of 30-in. from St. Mary Parish to near Monroe, La.
Status: Pending FPC approval.
Completion: Late 1961.
Project: 59 miles of 36-in. purchase lateral connecting Bastian Bay field, Louisiana.
Status: Pending FPC approval.
Completion: Fall 1961.

**WASHINGTON GAS LIGHT CO.,** 1100 H St., NW, Washington 5, D. C.
Project: 10.99 miles, 16-in. gas line near Lanham, Mo., and Lanham to Belair, Md.
Completion: September 1961.
Project: 20.66 miles various size distribution lines, Belair, Md.
Completion: September 1961.


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# TRAIN YOURSELF AND OTHERS IN SUPERVISORY TECHNIQUES FOR PROFESSIONAL ADVANCEMENT

Popular thinking on any subject is often like a pendulum, swinging forward in sheer exhilaration over an exciting idea, then backward to a cynical attitude against it. Years ago, health columnists extolled the nutritive qualities of spinach. Shortly thereafter, it was equally popular to decry spinach as an over-glamorized weed.

This vacillation springs from the efforts of spokesmen to capture interest, and the tendency of many people, like wild creatures in the forest, to give attention to whatever is moving regardless of the direction. That is why it sometimes seems that the more preposterous an idea the more credence it receives.

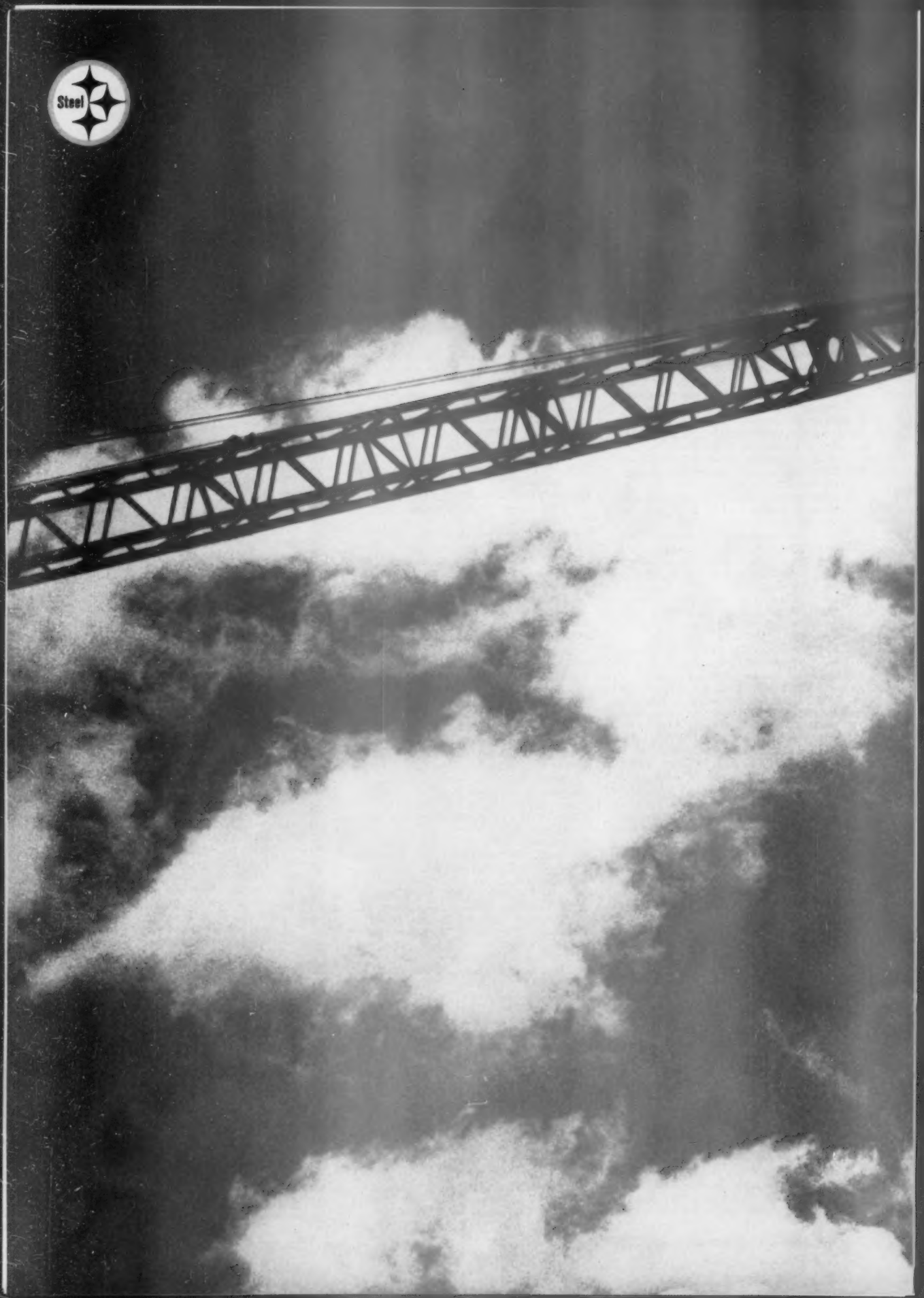
After World War II, supervisor and management development became extremely popular. Some of these programs naturally fell short of expectations, and there are always detractors — ready to display their intellectual brilliance by speaking cynically of *all* types of human relations training. Real progress in supervisory methods has, therefore, been slow.

Supervisory personnel, continually aware of the intrinsic values of human relations, are the key to uninterrupted production, completion of projects successfully and on time, for they forge the links in the productive chain solidly together.

Your management is interested not only in the creative, bold steps you would take into unknown solutions to problems, but also in how quickly and productively (profitably) you can put these ideas into practical application. When the solution, or idea, leaves your desk and starts down the long line of being put into practice, the supervisors throughout that chain of action will determine to a great extent whether their individual components will function properly or whether a project will bog down under the weight of misunderstanding and apathy.

It is extremely important, therefore, to maintain good supervisory practices throughout the various departments through which the original concept must be translated. It means a thorough understanding of human relations yourself, and the ability to communicate this understanding and appreciation to the supervisory personnel under you. This can and probably must be done both by individual contact with your supervisors and/or by conducting actual courses of study on the subject.

**FOOTNOTE:** the foregoing paragraphs are a direct quotation from another of Western's "personal-professional development" series. Booklet E-7, titled "Supervision — for Professional Advancement" a copy of which is yours upon request, without obligation. Write to WESTERN SUPPLY COMPANY, HEAT EXCHANGER DIVISION, P. O. Box 1888, Tulsa, Okla. — **where supervision contributes greatly to the manufacture of heat exchangers of the highest quality, and where personal attention to detail is our watchword.**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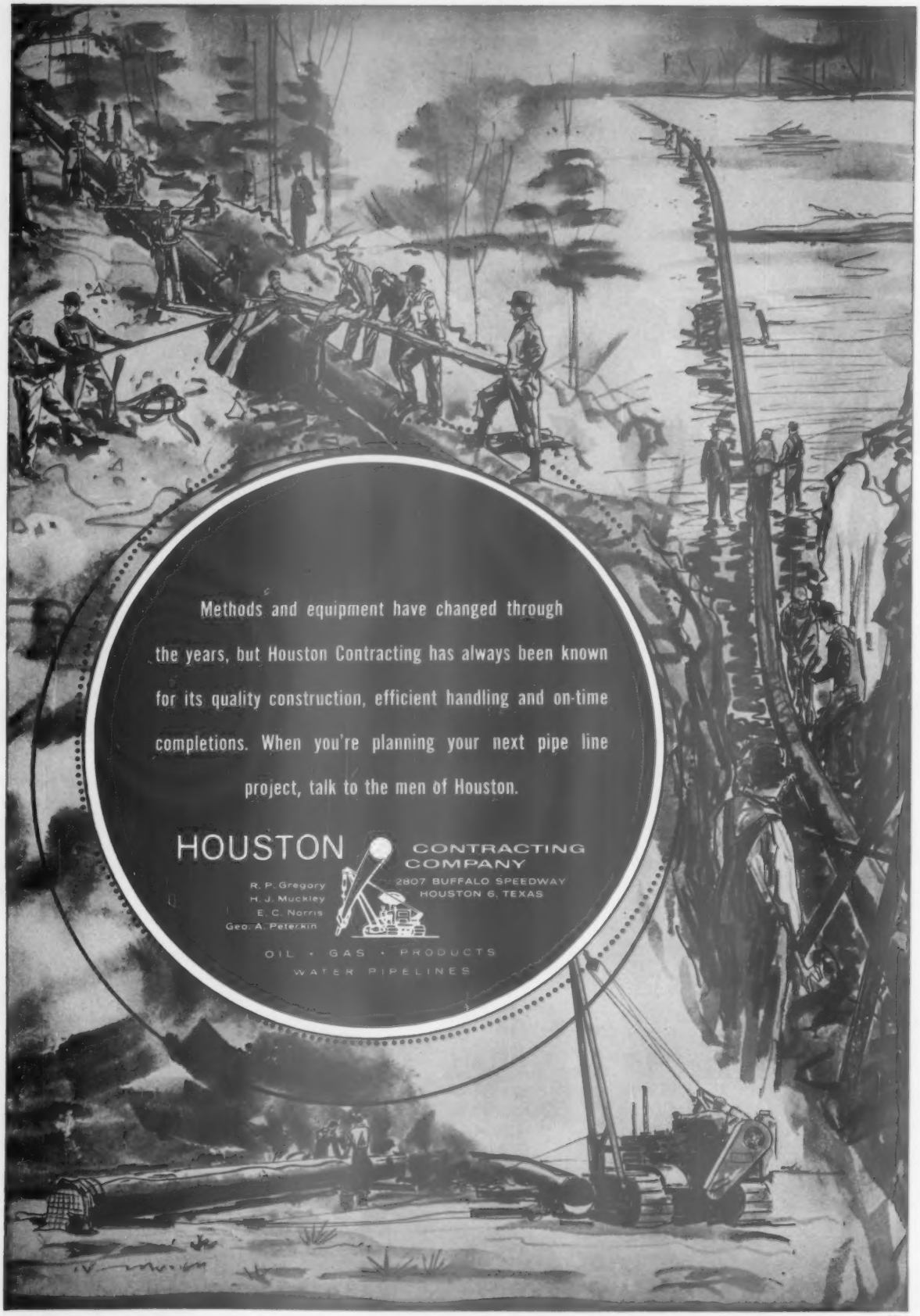
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## PIPELINE CONSTRUCTION

Project: 15.5 miles, 24-in. gas line at Hybla Valley, Va.
Completion: October 1961.
Project: 16 miles of 24-in. from near Alexandria, Va., to Prince Georges County, Maryland.
Status: Approved by FPC.

**WESTERN SLOPE GAS CO.**, Denver, Colo.
Project: 7-mile, 4-in. gas line from Powell Park field to Meeker, Colo.; 4-mile, 4-in. line from Section 11T7SR94W to Rifle, both to be completed by July 15, and 6 miles of 4-in. gathering lines to be completed by September 1.

## U. S. Miscellaneous Pipelines

**MONSANTO CHEMICAL CO.**, 800 North Lindbergh Blvd., St. Louis 66, Mo.
Project: 25-mile lines to move petrochemicals between proposed plant at Chocolate Bayou and Texas City.
Status: Planned.

**SUNOLIN CHEMICAL CO.**, 1608 Walnut St., Philadelphia 3, Pa.
Project: Ten 8-in. chemical lines from SunOlin's ethylene-oxide plant under construction at Claymont, across the Delaware River to a point north of Penns Grove, N. J.
Status: Planned.
Completion: Late 1961.

**TEXAS EASTERN TRANSMISSION CORP.**, Box 1189, Houston 1, Tex.
Project: 350 miles of 24-in. coal-slurry line to move West Virginia coal to electric companies in Pennsylvania, New York and New Jersey. (Texas Eastern is working jointly with Consolidation Coal Co., Pittsburgh, Pa.)
Status: Proposed.

## Canadian Crude Oil Pipelines

**BITUMINOUS OIL PIPELINE CO.** (Royalite Oil Co., Ltd., Royalite Building, Calgary.)
Project: A 250-mile line from Athabasca oil sands to Edmonton.
Status: Proposed.

**HUDSON'S BAY OIL & GAS CO., LTD.**, 320 7th Ave., Calgary, Alta.
Project: 41 miles of 4 and 8-in. condensate line from the Waterton-Castle River area and Pincher Creek field in southwestern Alberta to Carway near the international border. The new line would then connect with Continental Pipe Line's Glacier crude system in Montana and Wyoming.
Status: Pending approval. (Hudson's plans new company, Aurora Pipe Line Co., to operate line.)

**MATADOR PIPE LINE CORP.**, Denver, Colo.
Project: 175-mile line from Burke, Bottineau, and Renville counties, North Dakota, to Cromer, Man.
Status: Proposed. (See U. S.)

**MID-CONTINENT PIPE LINES, LTD.**, Edmonton, Alta.
Project: 1,500 miles of 30-in. from Edmonton to Chicago. U. S. section to be owned by International Oil Pipeline Corp., New York City.
Status: Pending Canadian Board of Transport Commission approval. W. C. Gilman & Co., New York City, has made preliminary study.

**RANGELAND PIPE LINE CO.**, Calgary.
Project: 111-mile line from Cessford field to Calgary.
Status: Pending approval of Alberta government.

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## PIPELINE CONSTRUCTION

12912 125 Ave., Edmonton, Alta.
Project: Expansion of gathering system in British Columbia will include 40 miles of 4-in. from Taylor to Dawson Creek; 30 miles of 6-in. from Boundary Lake to Taylor; 75 miles of 8-in. from Taylor to Milligan Creek, 11 miles of 4-in. from Milligan Creek to West Beaten; and 4 miles of 8-in. near the Taylor station.
Status: Under way.
Contractor: Banister Construction Co., Ltd., Edmonton.
Completion: By fall of 1961.

**WESTERN PACIFIC PRODUCTS & CRUDE OIL PIPELINES, LTD.,** 1155 West Georgia St., Vancouver 5, B. C.
Project: 500-mile, 12-in. line to carry crude and liquids from Taylor, B. C., to Kamloops where it will connect with the Trans Mountain line to Vancouver.
Status: Under way.
Completion: Late 1961.

## Canadian Products Pipelines

**ALBERTA GAS PRODUCTS SYSTEM, LTD.,** Calgary, Alta.
★ Project: 725-mile, 8-10-12-in. natural gas liquids gathering system in Alberta to connect with Interprovincial and Trans Mountain at Edmonton and to deliver to U. S. border.
Status: Before Alberta Conservation Board.

**BRITAMOIL PIPE LINE CO., LTD.,** Box 130, Calgary, Alta.
Project: 126-mile 6-in. line from Pincher Creek to Calgary.
Status: Pending approval of the Alberta Oil and Gas Conservation Board.

Project: 64-mile 8-in. line from Dick Lake to Edmonton, Alta.
Status: Pending approval of the Alberta Oil and Gas Conservation Board.

**FOOTHILLS PRODUCTS PIPE LINE LTD.,** (Pembina Pipe Line Co., Mannix Co., Ltd.), Calgary, Alta.
Project: 1,300 miles of 16-in. from Alberta to Chicago.
Status: Proposed. Standard Oil Co. (Ind.) will participate in the project.

**HUGHENDEN PIPELINE.**
Project: 125 miles from Dick Lake gasoline plant to underground storage in the Hughenden region of eastern Alberta.
Status: Pending approval of Alberta Oil and Gas Conservation Board.

**HYDROCARBONS PIPELINE, LTD.,** 239 Sixth Ave., SW, Calgary, Alta.
Project: 503-mile, 4 to 12-in. gathering system, with deliveries to Calgary, Innisfail, Hughenden, and Interprovincial Pipe Line Co.
Status: Pending approval of Alberta government.

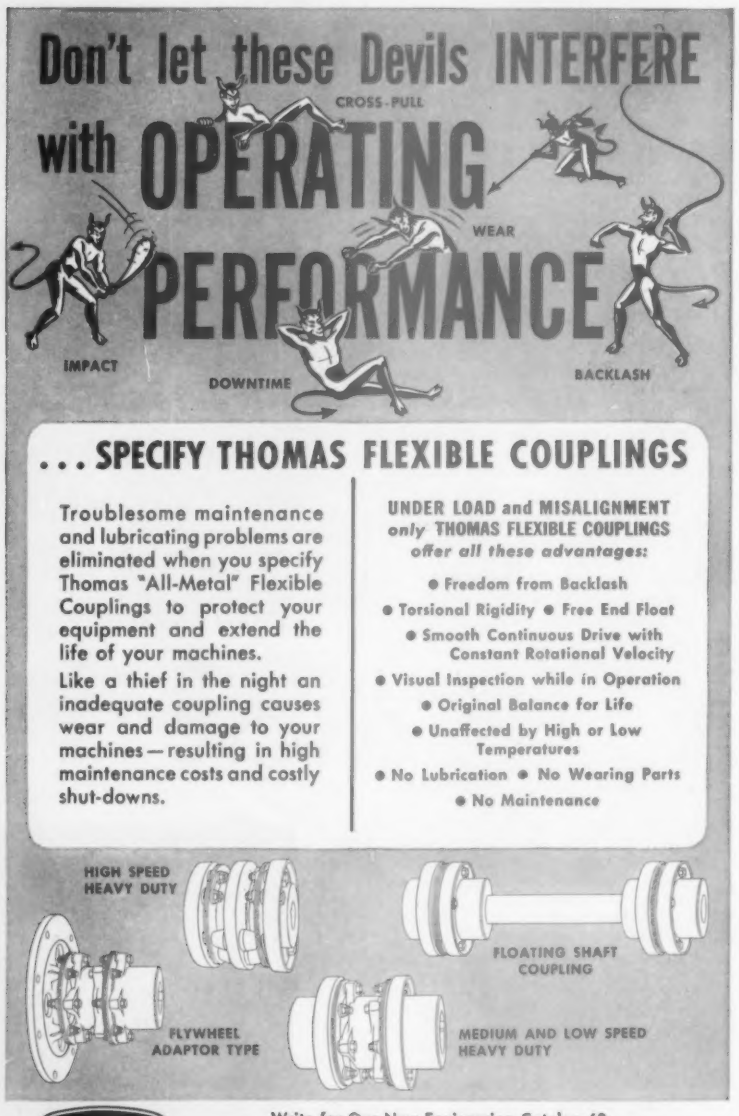
**PROVINCIAL PRODUCTS PIPELINES, LTD.**
Project: 700 miles of 4 to 12-in. line to pick up propane, butane, and condensates from natural-gas plants in Alberta for delivery to refineries and other plants.
Status: Pending approval of Alberta Oil and Gas Conservation Board.

**ROYALITE OIL CO., LTD.,** Calgary, Alta.
Project: 25-mile, 4½-in. condensate line to join Jumping Pound and Wildcat Hills absorption plants with Valley Pipe Line near Calgary.
Status: Proposed.

**WESTALTA PRODUCTS PIPELINE, LTD.,** (Pembina Pipe Line, Ltd., Edmonton, Alta.).
Project: 885-mile 4 to 16-in. gathering system to take natural-gas liquids from plants in Alberta for delivery to proposed Foothills trunkline to Great Lakes area.
Status: Pending approval of Alberta Board of Public Utility Commissioners. Standard Oil Co. (Ind.) will participate in the project.

## Canadian Natural Gas Pipelines

**ALBERTA GAS TRUNK LINE CO., LTD.,** Calgary, Alta.
Project: 226 miles of 36-in. and 125 miles of 30-in., plus laterals in southern Alberta including 58 miles of 22-in. and 64 miles of 16-in. (This is part of a 1,400-mile system to move Alberta gas to San Francisco.)
Contractors: Majestic Contractors, Ltd., Edmonton, has 113 miles of 36-in. from Crowsnest Pass to Priddis, 63 miles of 30-in. from Rocky Mountain House to Cynthia, and 38 miles of 22-in. lateral to the Rimbey region. Mannix Co., Ltd., Calgary, has 113 miles of 36-in. from Priddis to Rocky Mountain House. Dutton-Williams Brothers, Ltd., Calgary, has 62 miles of 30 in. from Cynthia to near Whitecourt, Alta., as well as a 20-mile, 22-in. lateral to the Whitecourt area. Piggott Construction, Ltd., Edmonton, has 64 miles of 16-in. lateral from Crowsnest Pass to Carway, Alta., on the U. S. border.
Completion: Dec., 1961.
Projects: The following laterals will be built in 1961 to tie in with the above project: 15 miles of 12-in. to Buck Lake, 23 miles of 22-in. to East Calgary, 15 miles of 16-in. to Carstairs, 4 miles of 8-in. to Sarcee, and 10 miles of 10-in. to Wildcat Hills. Other laterals to be built in the future will connect Kaybob,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## PIPELINE CONSTRUCTION

Berland River, Lovett River, and Stolberg.

**ALBERTA NATURAL GAS CO., LTD.** (Pacific Gas & Electric Co., San Francisco, and Westcoast Transmission, Calgary.)
Project: 108 miles of 36-in. from Crowsnest Pass across southeastern British Columbia to the U. S. border near Eastport, Idaho. (This is part of a 1,400-mile project to move gas from Alberta to San Francisco.)
Contractor: Price Poole of Canada, Ltd. (Canadian Bechtel, Inc., Toronto, is engineering manager.)
Completion: Dec., 1961.

**CANADIAN INDUSTRIAL GAS, LTD.** (formerly Ajax Petroleums, Ltd.), Derrick Building, Calgary, Alta.
Project: 28 miles of 10-in. and 4 miles of 8-in. from Morinville to Westlock Viking San field.
Status: Planned.
Completion: By September 1961.

**CARTIER GAS CORP.** (St. Maurice Gas Inc., and Consumers Gas Co., 19 Toronto St., Toronto.)
Project: Transmission and distribution in eastern townships and through to Quebec City in Quebec Province.
Status: Proposed.

**GAS TRUNK LINE OF BRITISH COLUMBIA, LTD.**, Pacific Bldg., Calgary, Alta.
Project: 245-mile, 30-in. extension of Westcoast Transmission system from Taylor, B. C., to Fort Nelson.
Status: Delayed to 1963 or 1964.

**MAGNA PIPELINE CO., LTD.**, Nanaimo, Vancouver Island, B. C.
Project: 53 miles of parallel 7-in. reinforced plastic pipe to serve Vancouver Island, B. C.
Status: Approved by British Columbia Public Utilities Commission.
Completion: 1963.

**NORTHERN ALBERTA PIPE LINES, LTD.**, Edmonton, Alta.
Project: 110-mile trunk line, plus gathering system, from Lac La Biche, in McMurray vicinity, to Edmonton.
Status: Pending provincial approval.

**ONTARIO NATURAL GAS STORAGE & PIPELINES, LTD.**, Catham, Ont.
Project: 14 miles, 10-in., 7 miles, 4-in. transmission line from Waterloo to Fergus, Ont., and 63 miles, 2-6-in. distribution lines.
Completion: August 1961.

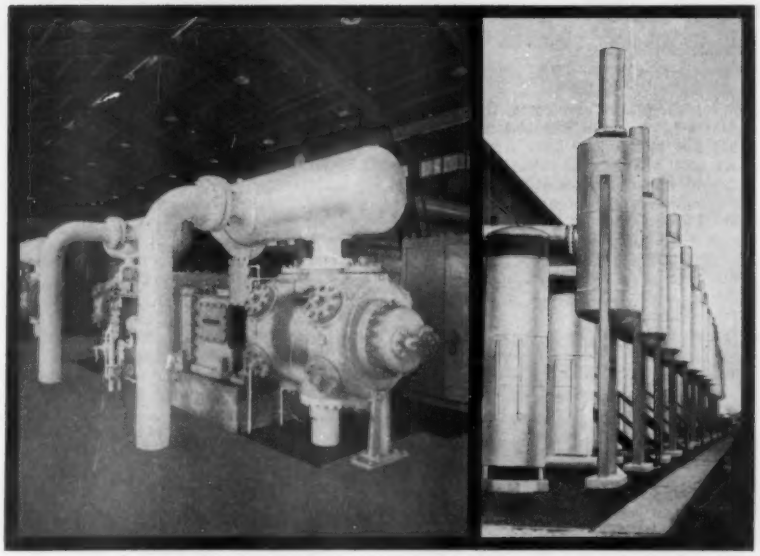
**SARATOGA PROCESSING CO., LTD.**, 406 Petroleum Building, Calgary, Alta.
Project: 67 mile gathering system (43 miles 16-in., 24 miles 4-10-in.) for Coleman, Alta., processing plant.

**SASKATCHEWAN POWER CORP.**, Regina, Sask.
Project: Line from Canora to Preeceville, Sask., 20.07 miles 6-in. and 15.15 miles 4-in.
Status: Planned.

**WESTCOAST TRANSMISSION CO., LTD.**, Calgary, Alta.
Project: 688-mile, 30-in. loop of British Columbia-Washington line.
Status: Proposed.
Project: (See Alberta Natural Gas Co., Ltd., for joint project.)

## Foreign Crude Oil Pipelines

**ABU DHABIE MARINE AREAS, LTD.** (partly owned by British Petroleum Co., Britannic House, Finsbury Circus, London E.C. 2).
Project: 20 miles of 18-in. from offshore Persian Gulf pool to Das Island.

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## PIPELINE CONSTRUCTION

Completion: 1962.

**COMPAGNIE d'EXPLORATION PETROLIERE**
Project: 330-mile line from Ohanet to Hassi Messaoud to connect with existing line to Bougie.
Contractors: First 140 miles by SOCOMAN; remainder by GREP.
Completion: June 1961.

**ALGERIAN LINES.**
Project: 75-mile 10-in. line to link the new oil field, El Gassi-El Agreb, with the existing Hassi Messaoud-Bougie line. SNPA is field operator.
Status: Planned.

**AMINOIL,** Mena Abdulla, Kuwait
Project: 33-mile, 24-in. from Wafra to Mina Abdulla, Kuwait.
Completion: August, 1961.
Contractor: Contracting & Trading Co.

**ARABIAN AMERICAN OIL CO.,** 505 Park Ave., New York 22.
Project: 27-mile, 24-in. crude line from northern Safaniya to southern Safaniya.
Status: Planned.
Completion: Second quarter, 1962.
Contractor: Aramco-Bechtel.

**ARABIAN AMERICAN OIL CO.**
Project: 6.5-mile, 6-in. LPG line from Ras Tanura refinery to Ras Tanura terminal.
Status: Under construction.
Completion: Second quarter, 1961.
Contractor: Aramco-Bechtel.

**ATTOCK OIL CO., LTD.,** Morgah, Rawalpindi, West Pakistan.
Project: 55-mile, 6-in. line from Dhulian field to Morgah refinery.
Completion: July 1961.
Contractor: Motherwell Bridge Contracting and Trading Co., Ltd.

**BARNABO GROUP** (Italian interests).
Project: A line from Venice, Italy, to Innsbruck, Austria, which could then be extended to Munich, Germany.

**BASRAH PETROLEUM CO.,** London, England.
★ Project: 20 miles, 16-in. gathering lines, Rumaila.
Contractor: Mothercat Co., Ltd.
Completion: Sept., 1961.
Project: 37-mile line from Rumalia field to power plant at Basra.
Status: Contract let.
Completion: March 1962.
Contractor: SAIPEM.

**CIE. de RECHERCHE et d'EXPLOITATION PETROLIERE au SHARA,** Paris.
★ Project: 40 miles, 4-8-in. gathering lines, El Adeb Larache field.
Status: Proposed.
Contractor: Socoman.
Completion: January, 1962.

**COUNCIL FOR MUTUAL ECONOMIC AID** (Comecon).
Project: 2,800-mile system from the Volga-Ural oil fields in Russia to East Europe satellite countries.
Status: Construction under way in Poland, Hungary, and Czechoslovakia.

**ESSO STANDARD (LIBYA), INC.**
Project: 100 miles of 30-in. from Zelten field to Gulf of Sirte.
Status: Under way.
Contractor: Arabian Bechtel Corp.
Completion: Mid-1961.

**GERMAN LINE** planned by eight German refining and marketing companies (British Petroleum, Esso, Deutsche Erdoel, Shell, Gelsenberg-Benzin, Mobil, Schloven-Chemie, and Wintershall).
Project: 155-mile, 24-in. line to Bavaria from Karlsruhe.
Status: Planned.

**IRANIAN OIL EXPLORATION & PRODUCING CO.**
Project: 30 miles of 20-in. and 22 miles of 16-in. looping of Agha Jari to Bander Mashur line.
Status: Planned.

**IRAQ PETROLEUM CO.**
Project: Two 25-mile, 32-in. crude lines to offshore loading dock in Persian Gulf.
Status: Under way.

**IRAQ PETROLEUM CO., LTD.,** 214 Oxford St., London W 1, England.
Project: Looping of Kirkuk-Mediterranean system is under way on a 66-mile stretch between K-1 and K-2 stations and on an 81-mile stretch between K-3 towards the Syrian border. In Syria, a 28-mile section of 30-in. is under way.

**KUWAIT OIL CO., LTD.,** Burgan House, London, England.
★ Project: 31 mile, 24-in. crude line from Minagish to Ahmadi South tank farm.
Status: Planned.
Completion: Mid-1962.

**MENE GRANDE OIL CO.,** Apartado 709, Caracas, Venezuela.
Project: 16-in. line at Block 11, Maracaibo.
Completion: December 1961.

**OASIS OIL CO. OF LIBYA,** 539 South Main St., Findlay, Ohio. (Other participants are Esso Sirte and Libyar American Oil Co.)
Project: 86 miles of 30-in. from the Dahra area of Libya to El Sider on the Mediterranean coast, and 36 miles of 20-in. feeder line from the Mabruk area to the 30-in. line.

**OIL INDIA, LTD.** (Burmah Oil Co. and Assam Oil Co., two-thirds, and India Government, one-third.)
Project: 720 miles of line in northeast India. This will include 250 miles of 16-in. from Nahorkatiya to Noonmati


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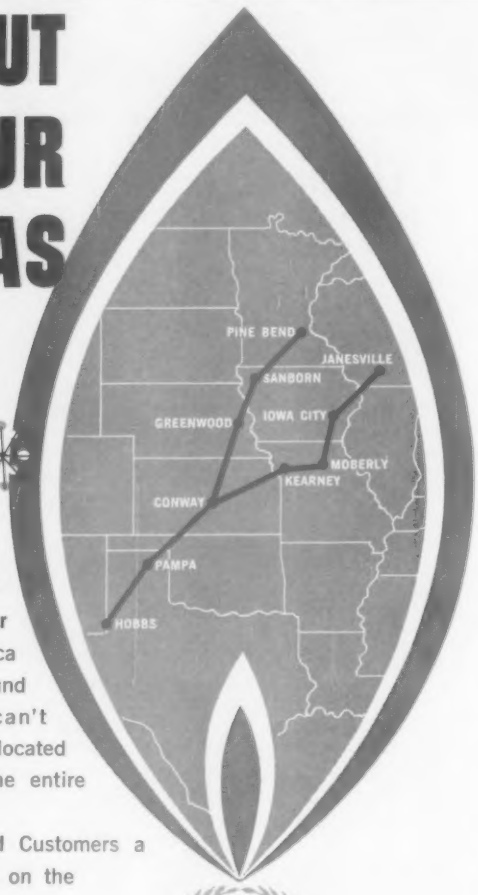


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## PIPELINE CONSTRUCTION

and 470 miles of 14-in. from Noonmati to Barauni.
Contractors: Mannesmann, a German firm, and SAIPEM, a member of the ENI group.
Status: Under way.
Completion: The 16-in. system is scheduled for completion late 1961.

**PETROLEO BRASILEIRO S.A.** (Brazil).
Project: 250-mile line from Rio de Janeiro to Belo Horizonte refinery site.
Status: Under consideration.
Project: 35 miles of 8 to 12-in. pipe from Buracica to Candeia.
Contractor: Techint, Inc., Milan, Italy.
Project: 80 miles of 24-in. to tie in to proposed Caxias refinery near Rio de Janeiro.
Status: Planned.

**PHILLIPS PETROLEUM CO.**, Bartlesville, Okla.
Project: 14-in. line in Block 17, Lake Maracaibo, Venezuela.
Status: Planned.
Contractor: Chicago Bridge & Iron Co.

**ROYAL DUTCH-SHELL.**
Project: 12-mile line from Gore Bay, Australia, to Royal Dutch-Shell's Clyde refinery.
Status: Planned.
Project: 161 miles 20-in. line from Tandzung field to Balikpapan refinery, Borneo.
Status: Planned.
Contractor: Williams Brothers Overseas, Ltd., Tulsa, and John Brown, Ltd., London.
Completion: January 1, 1962.

**SINCLAIR VENEZUELAN OIL CO.**, Apartado 1706, Caracas, Venezuela.
Project: 17.35 miles, 8-in. crude line from East Aguasay to south bank of Tonoro River to connect with existing 8-in. line.
Status: Planned.
Completion: Late 1961.

**SNAM-SUEDPETROL**, Milan, Italy.
Project: 20-in. crude line from Genoa to Ingolstadt, Austria, via Switzerland.
Status: Planned. Construction expected to begin in 1961.

**SOUTH EUROPEAN PIPELINE CO.** (Jersey Standard, Caltex, Shell, British Petroleum, and 12 other firms.)
Project: 419-mile, 30 in. line from Lavera, near Marseille, to Strasbourg, with 40-mile extension to Karlsruhe, Germany. This may be extended into lower Batavia with a 155-mile, 22-in. segment.
Status: Under way.
Completion: 1963.

**SYRIAN LINE.**
Project: About 320 miles of 6-in. from interior of Syria to link Homs refinery with various fields.
Status: Under way.
Contractor: The Italian firm, Techint.
Completion: In 1962.

**UNION OF SOVIET SOCIALIST REPUBLICS.**
Project: 2,315 miles of 28-in. Trans-Siberian crude-products line from Ufa and Tuimazy fields in Bashiria to Irkutsk.
Status: Under way.
(See Council for Mutual Economic Aid for information on new East Europe line.)

**YACIMIENTOS PETROLIFEROS FISCALES** (Argentina), Buenos Aires.
Project: 390 miles of 14-in. from fields in Neuquen Province, Argentina, to Bahia Blanca.
Status: Under way.
Project: 625 miles of 12-in. from Mendoza to San Lorenzo.
Status: Planned.

## Foreign Products Pipelines

**ARABIAN AMERICAN OIL CO.**, Dhahran, Saudi Arabia, and 505 Park Avenue, New York.
Project: 37 miles of 8-in. LPG line frrom Abqaik to 'Ain Dar.
Contractor: Aramco-Bechtel.
Completion: 1961.


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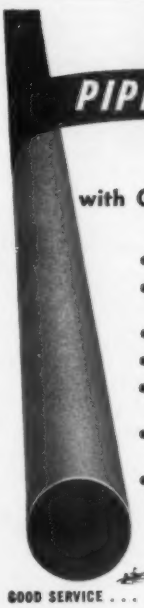

- Asbestos Felt and Rock Shield
- Glass Pipeline Wraps
  Mfd. by Owens-Corning Fiberglas Corp.
- Tapes
- Kraft Wraps
- Casing Seals
  Mfd. by Irish Pipe Line Supply Co.
- Alpon Internal Pipe Coating
  (Epoxy Coating)
- Tar-Clad
  (Coal Tar Epoxy Coating)

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AINSLIE PERRAULT V. V. MALCOM

## PIPELINE CONSTRUCTION

**CIE. FRANCAISE DE PETROLES,** Paris, France.
Project: 187-mile, 8-in. condensate line from Hassi R'Mel dehydration plant to Haoud-el-Hamra station on Hassi Messaoud-Bougie crude oil line.
Status: Under way.

**INDIA GOVERNMENT.**
Projects: 600-mile line across northern India from Barauni to Delhi via Kanpur, Lucknow, and Allahabad; 300-mile combination crude and products line from Bombay to Bhusaval; 120-mile products line from Bombay to Poona to be extended 300 miles, later, to Hyderabad; and a 350-mile products line from Cochin to Madras via Bangalore.
Status: Proposed. Recommendation has been made to start work on three of the systems immediately, with completion in 5 years. The fourth system would be started in 1963. Which might be built first was not disclosed.

**NATIONAL IRANIAN OIL CO.,** Tehran, Iran.
Project 360 miles of 8-in. from Rey to Meshed, Iran.
Status: Under way.
Contractor: William Brothers, Tulsa.

**NORTH ATLANTIC TREATY ORGANIZATION.**
Project: 57 miles of 8-in. in Germany to Land Baden-Wuerttemberg air field.
Project: 93 miles of 6-in. in Turkey.

**PETROLEOS MEXICANOS,** Avenida Juarez 92-94, Mexico City, Mexico.
Project: 500-mile line from Minatitlan to Mexico City.
Status: Planned, with construction starting in 1961.
Completion: 12 to 18 months after construction starts.
Project: 270 miles of 8-in. from Torreon to Chihuahua.
Status: Under way.
Completion: September 1961.

**PIPELINES OF PUERTO RICO,** San Juan.
Project: 95 miles 8-in. from Penuelas to Catano.
Status: Approved by Puerto Rican Public Service Commission.

**SYRIAN PIPELINE.**
Project: About 310 miles from Homs to tank farms in the Damascus, Aleppo, and Latakia areas.

**UNION OF SOVIET SOCIALIST REPUBLICS.**
Project: 2,315 miles of 29-in. Trans-Siberian crude-products line from Ufa and Tuimazy fields in Bashiria to Irkutsk.
Status: Under way.
Project: 700 miles from Novo-Kuibyshev refinery to Bryansk.
Status: Under way.

**YACIMIENTOS PETROLIFEROS FISCALES** (Argentina), Buenos Aires.
Project: 652 miles of 10-in. from Lujan de Cuyo to Buenos Aires.
Status: Planned.

## Foreign Natural Gas Pipelines

**ATTOCK OIL CO.,** 26-28 Fenchurch st., London E. C. 3.
★ Project: 56-mile, 6-in. from Dhulian to Rawalpindi.
Contractor: Mothercat Co., Ltd.
Completion: June 1961.

**BASRAH PETROLEUM CO., LTD.,** 214 Oxford St., Oxford Circus, London W. 1, England.

**GASES NATURALES DE COLOMBIA, S.A.** (Owned 50% by Colombian Petroleum Co., which is affiliated with Mobil International and Texaco, and 50% by local interest.)
Project: 140 miles of 10-in. from Cicuco field to the Caribbean port of Barranquilla.
Completion: Late 1961.

**INTERNATIONAL GAS CO.,** Los Angeles, Calif.
Project: 1,840-mile, 30-in. gas line from Reynosa to Mexicali via Monterrey, Mazatlan, etc.
Status: Proposed.

**ISRAEL GOVERNMENT** and private interests.
Project: 75 miles of 16-in. to power a plant at Ashdod Yam on the Mediterranean coast.
Status: Planned.

**NIOGAS.**
Project: 82 miles of 8 and 10-in. to connect Traismauer and Amstetten in Austria.
Contractor: Williams Brothers, Tulsa.

**PAKISTAN INDUSTRIAL DEVELPMENT CORP.**
Project: 1,000-mile system to carry gas from Sui field northward from Multan to Lyallpur, Lahore, Daudkhel, Islamabad, Rawalpindi, and Wah. This would require a loop to an existing 310-mile 16-in. line from the Pakistan petroleum field to Multan.
Status: Under consideration. Technical survey has been ordered.

**PAKISTAN PETROLEUM CO.**
Project: 145 miles of 8-in. from Sylhet field to Daccq, East Pakistan.
Status: Proposed.

**PETROLEOS MEXICANOS,** Avenida Juarez 92-94, Mexico City, Mexico.
Project: A 500-mile northward extension of the newly completed gas line from Ciudad Pemex to Mexico City. It would extend to Queretaro, Salamanca, San Luis Potosi, and Guadalajara.
Status: Planned.
Project: 270 miles of 12-in. from Torreon to Chihuahua.
Status: Under way.
Completion: September 1961.
Project: For proposed Texas to California line through Mexico, see Tennessee Gas listing below.

**QATAR GOVERNMENT,** Abu Dhabi, Qatar.
★ Project: 70-mile, 16-10-6-in. from Dhukan to Doha.
Contractor: Mothercat Co., Ltd.
Completion: June 1961.

**SOC. SICILIANI METANDOTTI (SOSIM).** Partners include Edison Power, Italcementi, Fiat Motor, Sicilian SGES Power, Bombrini Parodi Delfino Chemical, and Montecatini.
Project: 560 miles from Hassi R'Mel gas field, Algeria, to Cape Bon, Tunisia, 77 miles across the Sicilian Channel, into northern Italy and beyond.
Status: Engineering studies under way.

**SOTHRA.**
Project: A 315-mile system from Hassi R'Mel gas field in Algeria to the Mediterranean coast, including 262 miles of 24-in. trunk from Hassi R'Mel to Relizane and 20-in. from Relizane to Arzew, plus branches to Oran and Algiers.
Status: Under way.
Contractors: Groupement Entrepose - Ste. Parisienne pour l'Industrie Electrique (GREP) has contract for 200 miles from Hassi R'Mel to Tiaret. Socoman has contract for 115 miles from Tiaret to Arzew.
Completion: Spring 1961.

**STANDARD - VACUUM OIL CO.,** New York.
Project: 60 miles of 8-in. from Radja field to Palembang, Sumatra, to supply fertilizer plant planned by the government.
Status: Planned.

**TEIKOKU OIL CO.** and **TOKYO GAS CO.**
Project: These two companies are negotiating a proposed 200-mile, 12-in. system to move gas from Kubiki gas field in Japan.
Status: Proposed.

**TENNESSEE GAS TRANSMISSION CO.,** Box 2511, Houston, Tex.
Project: 1,100-mile, 30-in. line from Reynosa, near the southern tip of Texas, across Mexico to San Luis Rio Colorado, near the California border.
Status: Agreement signed by Petroleos Mexicanos and Tennessee Gas Transmission. Pemex would own the Mexican portion of the system. Pending FPC, California PUC approval.

**UNION OF SOVIET SOCIALIST REPUBLICS.**
Project: New line from gas fields in western Ukraine to the Polish border.
Status: USSR has signed agreement with Poland.
Project: 250-mile line from Ust-Vilyuisk field to the Siberian cities of Yakutsk and Pokrovsk. plus feeder lines to supply villages in the Lena River Valley.
Status: Planned.
Completion: Date not set yet.
Project: Two parallel, 40-in. lines, each over 1,300 miles long, from Gazli, near Bukhara, northward to Sverdlovsk and Chelyabinsk.
Status: Planned.
Project: From Tashkent to Chimkent, Dzhambul, Frunze and Alma-Ata near Chinese border.
Completion: By 1965.
Project: Line from Berezovo field southward to Sverdlovsk.
Status: Proposed.
Project: Line from Minsk northward to Baltic Sea area.
Completion: To Vilnius, Lithuania, in 1961; to Riga, Latvia, in 1962.
Project: Line from Minsk northeast to Leningrad.
Status: Proposed.
Project: 800-mile, 40-in. line from Krasnodar fields north of Caucasus Mountains to Serpukhov, south of Moscow, via Rostov and Lugansk.
Status: Under way.
Project: 310 miles of 32-in. line ringing Moscow at radius of about 50 miles.
Status: Under way.
Completion: 1962.

**YACIMIENTOS PETROLIFEROS FISCALES** (Argentina), Buenos Aires.
Project: 1,050-mile line from Comodoro Rivadavia to Buenos Aires with a spur to Plaza Huincul field in Neuquen Province. Line will be 26 in. to Plaza Huincul and 30 in. to Buenos Aires.
Status: Proposed.


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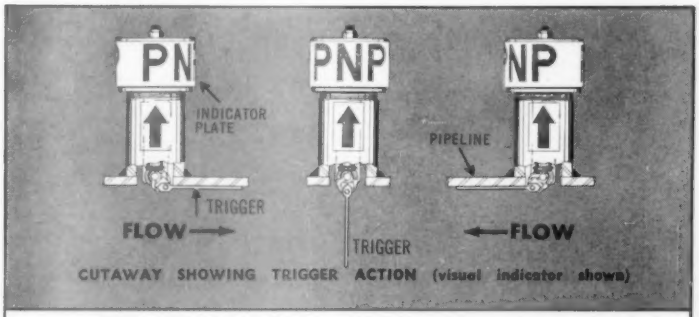
**Box 1260** **Tulsa 1, Okla.**

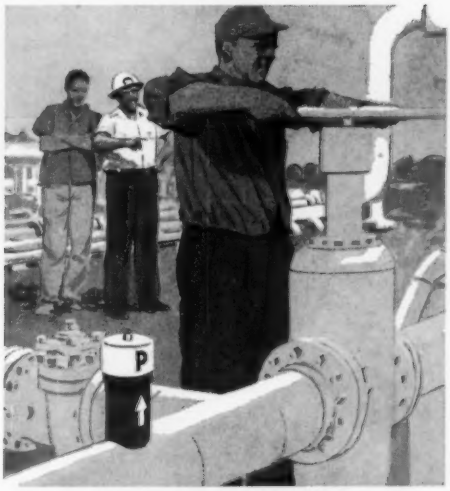
# NEWS FROM DOWN THE LINE!

## Successful PIG-SIG II
## now has NEW BI-DIRECTIONAL TRIGGER
### Plus Other Optional Features



CUTAWAY SHOWING TRIGGER ACTION (visual indicator shown)

• The WmSon PIG-SIG II Scraper Passage Indicator which has earned such wide acceptance in the pipeline industry is now available with bi-directional trigger as an optional feature. The trigger is designed for use in lines where scraper travel may be in either direction and in meter proving loops. Other optional features: pneumatic control with automatic reset and automatic counter to record scraper passage.



Long trigger action detects scrapers even in oversize pipe

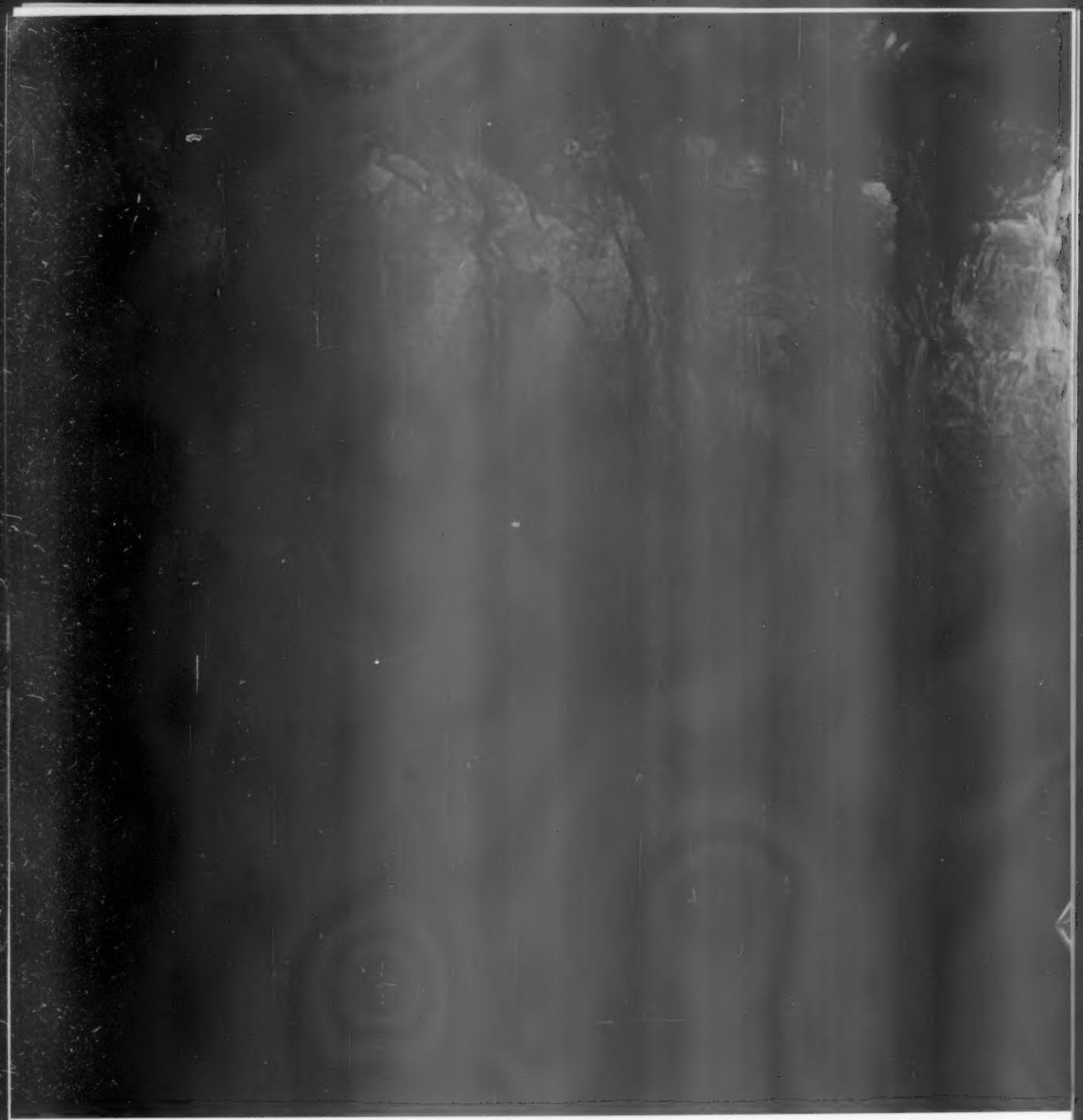
In the top example, PIG-SIG II with visual indicator shows the station operator the pig has arrived. He doesn't need to wait and listen at the scraper trap. The next example shows how PIG-SIG II with electric indicator can signal arrival of pig to pump station operator. It can start operation of automatic equipment to open and close valves. PIG-SIG II is easily installed under pressure with WmSon-Hillco Tapping Machines. It is available with visual indicator and manual reset; electrical or pneumatic signal with automatic reset; extended or regular.

FOR ADDITIONAL INFORMATION
WRITE DEPT. A FOR BULLETIN A-199-A

PIG-SIG II PATENT PENDING

**T. D. Williamson, Inc.**
P. O. BOX 40 • TULSA 2, OKLAHOMA
REPRESENTATIVES AROUND THE WORLD

**PIG-SIG II** can be used to actuate pneumatic and electric control systems. WmSon engineers may be able to offer dollar saving tips on its use in such systems. **Contact your representative or the Tulsa office.**



IF YOU RELY ON SERVICE,
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Photographed in limestone mine of PPG's Chemical Division at Barberton, Ohio.

Hydrogen peroxide cotton bleaching time cut 60% . . . that's what Columbia-Southern technical ability linked with knowledge of industry needs developed for the textile trade. Vapor degreasing output boosted to all time high . . . that's an example of results achieved by the combination of Columbia-Southern Trichlor and knowledgeable technical service to the metalworking industry.

Pulp processors, glass manufacturers, leather tanners, petroleum refiners and other producers rely heavily on the service that supports Columbia-Southern Chemicals.

They've learned that this counsel gives them the best mileage on the chemicals they buy. Because of this practical technical assistance, combined with consistently high quality standards and cost-cutting traffic control, discriminating buyers in every industry specify Columbia-Southern Chemicals. You too may profit by doing so.

Chemical Division, Pittsburgh Plate Glass Company, One Gateway Center, Pittsburgh 22, Penna. Offices in principal cities. In Canada: Standard Chemical Limited.

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Barium Chemicals • Sulfur Chemicals • Agricultural Chemicals
Reinforcing Pigments • Calcium Chloride • Hydrogen Peroxide
Muriatic Acid • Calcium Hypochlorite • Titanium Tetrachloride

# SEAL'S LEAKING!

## *How much will the downtime cost?*

Even the best-running shaft seal on a mechanical mixer is going to wear out some day.

What you pay for the shutdown depends on how fast you can get back into production.

This is a good point to settle *before* you choose the mixer. The right answer can save you as much as *$1,000 per seal change.* (Based on conservative estimates of downtime production losses, plus direct labor cost. We've seen savings go much, much higher.)

The close-up below shows why you're ahead with a LIGHTNIN Mixer, equipped with a LIGHTNIN Rotary Mechanical Seal. Notice this patented seal is an integral cartridge unit. It saves buying separate seal parts and wondering if they'll work when you put them together.

The LIGHTNIN Seal needs no special skill to replace. It bolts in place without dismantling the mixer, without entering the tank. Aligns itself automatically. Doesn't have to be checked. You *know* it's going to work. (We never ship a seal until we've tested it statically and dynamically at rated pressure.) Gets you back onstream fast—without trouble, without tricky adjustments.

If you'd like to look further into the dollars and sense of pressure-vessel mixing with seal-equipped LIGHTNIN Mixers, your LIGHTNIN man has some interesting figures to show you. You'll find his name in Chemical Engineering Catalog and in the yellow pages of your telephone directory. Call him today. Or write directly to us.

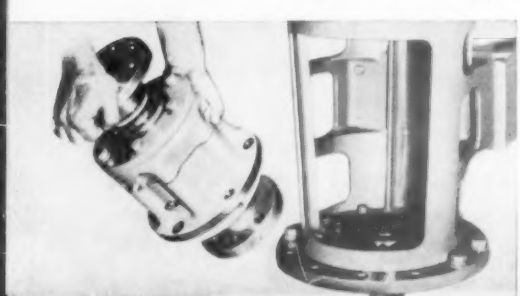
**BEWARE OF "HIDDEN" MIXING COSTS**

When choosing a mixer, ask yourself these six questions. Even one "yes" answer means you'll pay a needlessly high price—in lost production and in labor—to mix fluids.

**To change or replace a shaft seal, will you have to:**

| | YES | NO |
|---|---|---|
| 1. Check the new seal and sleeve for leaks? | ☐ | ☐ |
| 2. Dismantle mixer or remove it from vessel? | ☐ | ☐ |
| 3. Use skilled manpower to replace seal part by part? | ☐ | ☐ |
| 4. Purge vessel in order to block up mixer shaft? | ☐ | ☐ |
| 5. Uncouple mixer shaft *inside* the vessel? | ☐ | ☐ |
| 6. Check alignment of the mixer gears, shaft, or bearings? | ☐ | ☐ |

**You avoid *every one* of these needless "hidden costs" when you mix with seal-equipped LIGHTNIN Mixers.**



**This seal could save you $1000 in case of a shutdown.**

*Lightnin® Mixers*

**MIXCO fluid mixing specialists**

**MIXING EQUIPMENT CO., Inc.**
**174-e Mt. Read Blvd., Rochester 3, N. Y.**
*In Canada: Greey Mixing Equipment, Ltd.*
*100 Miranda Ave., Toronto 19, Ont.*
*In Europe: Lightnin Mixers, Ltd.*
*Poynton, Cheshire, England*

# What's NEW . . . in equipment

## Back-fill blade makes trencher useful for two ditching jobs

A COMPANION backfill blade now available for the T-66 trencher permits one man with the machine to both ditch and backfill. The 42-in. backfill blade attaches directly to the digging boom which is hydraulically controlled. This design lets the operator raise and lower the blade as he wishes. The blade can be set straight or angled to the left for parallel backfilling.

Direction of travel of the machine can be quickly changed through the operation of a hand level which controls the reversing mechanism. Source: **Davis Mfg., Inc.,** 1500 S. McLean Blvd., Wichita 13, Kans., U.S.A.

## New low-water-loss cementing additive

A LOW-WATER-LOSS cementing additive has been developed which is said to offer superior characteristics for primary and remedial cementing. Tradenamed Halad-9, the product is a free-flowing powder that can be added to the dry cement or to the mixing water.

In most cements, the maker says 1% of the product will provide a sufficient filtration reduction for squeeze cementing, and will produce a fluid loss from 50 to 60 cc., as measured on 325-mesh screen under 1,000-psi. pressure. However, the fluid loss of different compositions can be varied to fit most well requirements by raising or lowering the concentration of the product.

The product reportedly offers a number of principal advantages in a cementing composition. For casing cementing, it lessens the possibilities of water and/or emulsion blocks, and blocks caused by bentonitic clay swelling due to filtrate from cement. And it helps protect water-sensitive shales and reduces premature bridging in annuli which may be caused by dehydration.

For squeeze cementing, the product is said to reduce premature dehydration in tubing and casing while squeezing perforations. Long perforated intervals can often successfully be squeezed in a single stage.

The product has a mild retarding effect on the thickening time and early strengths of most cements. It has been used in API Class E cements to temperatures in excess of 300° F. and found to be very heat stable. Source: **Halliburton Co.,** Duncan, Okla., U.S.A.

●

### Seventy-amp. time switch

Plunger-action copper contacts U. L. listed for all types of loads, including tungsten lamps, are featured on a new time switch. It has pressure type of terminals for wire

**Need more facts on the items described on these pages?**

**The manufacturers will gladly supply them. They're shown in bold type, with their addresses. For convenience, send this coupon to the manufacturer.**

ITEM _____

_____

OIL AND GAS JOURNAL
May 29, 1961

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COMPANY _____

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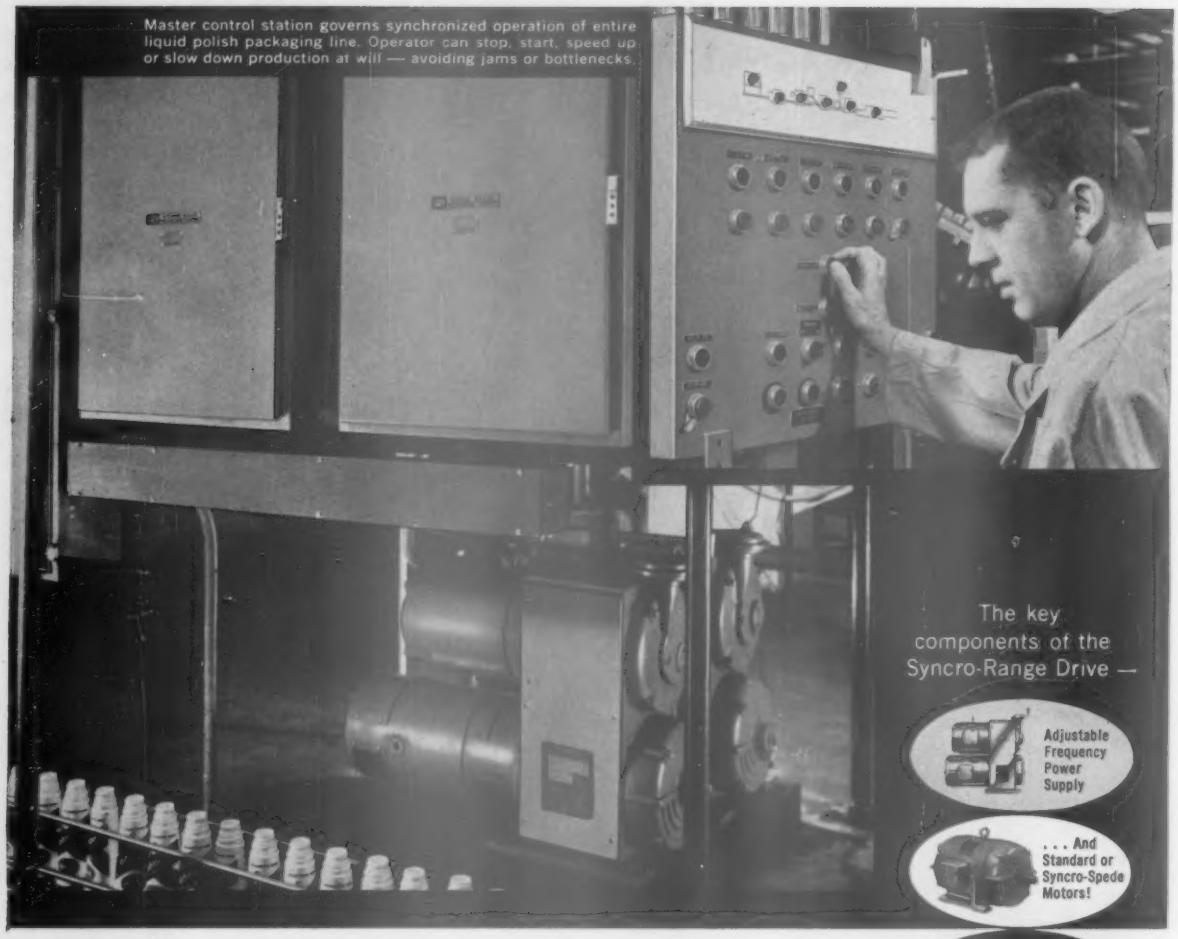
Master control station governs synchronized operation of entire liquid polish packaging line. Operator can stop, start, speed up or slow down production at will — avoiding jams or bottlenecks.
The key components of the Syncro-Range Drive —
Adjustable Frequency Power Supply
. . . And Standard or Syncro-Spede Motors!

# LOUIS ALLIS SYNCRO-RANGE DRIVES automate liquid polish lines

## Johnson's Wax, renowned wax and polish producer, uses Syncro-Range Drives for exact control of process lines

Controlling the speed of the precise, mass-production lines for their new, highly successful liquid shoe polish was the task Louis Allis engineers had to solve for Johnson's Wax.

The problem was to time the flow of plastic bottles, liquid polish, wool daubers, and caps into the packaging lines at precisely equal rates. Flow rate must be adjustable so the lines can be slowed down or speeded up. And the entire packaging operation must be controllable from a single master control. The Louis Allis Syncro-Range Drive solved the problem.

Syncro-Range Drive provides synchronized speed of any number of motors from a single control. It is a "packaged system" comprising an adjustable frequency power supply operating on 3 phase, 60 cycle power input . . . a group of Syncro-Spede® synchronous motors which maintain exact synchronism regardless of varying load . . . and a control which permits the speed of the entire group of motors to be simply adjusted without losing synchronization. On applications for which exact synchronism is not required, standard squirrel cage motors can be supplied.

You can readily see the advantages of the Syncro-Range Drive in systems or processes which require synchronized movement: multiple conveyors which feed consecutively; transfer lines; process lines; assembly lines requiring coordinated arrival of components; printing where one press feeds another; synthetic fibre spinning, drawing, or twisting; metal runout tables; and other similar machines which require the application of power at a number of points on the machine.

The Syncro-Range Drive is available with a choice of drive sizes to efficiently control from 2 to 200 motors. Control features are available to provide speed regulation accurate to 0.1% with 0% relative speed difference between motors! A trained Louis Allis motor application engineer is available to help. You can reach him at your local Louis Allis District Office, or by writing to The Louis Allis Company, 449 East Stewart Street, Milwaukee 1, Wisconsin.

ASD-232

**LOUIS ALLIS**

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

sizes 14 to 4. These are integral with the contact assembly.

The switch comes with a heavy-duty timing motor said to be suitable for either indoor or outdoor use and delivering full torque in temperature extremes.

Power is delivered to the dial through a precision-cut gear train with a vernier setting knob for conveniently resetting the time of day following current interruptions. The switch can be operated manually without interfering with subsequent automatic operations. Optional for the switch is an omitting device for eliminating the "on" operation on any selected day or days. Source: **Reliance Automatic Lighting Co.,** 1932 Meade, Racine, Wis., U.S.A.

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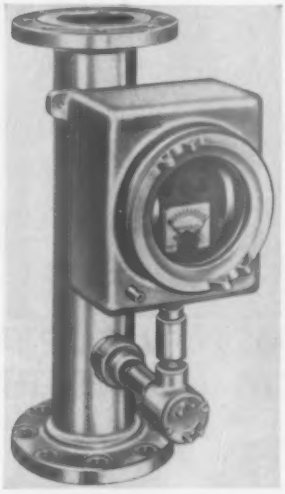

## New b.s. and w. monitor for LACT systems

A removable glass window on this TDM-X dielectric monitor lets you see the control panel easily. The instrument is designed to indicate continuously the per cent of b.s. and w. in crude oil as it flows through a measuring probe. Housed in an explosionproof housing, the control assembly is mounted directly on the capacitance cell.

The instrument is calibrated directly in per cent b.s. and w. Minor adjustments of only two control knobs allow the operator to set the control circuit at a point to prevent shipping bad oil, and also set a low limit for actuating the control circuit.

Monitor features include a transistorized circuit, replaceable plug-


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**MILLS IRON WORKS, INC.**
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Weld Saddles.

**VOLCANO BURNER COMPANY**
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**WESTERN SAFETY BARREL STAND**
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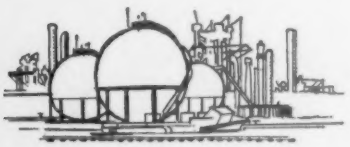

DELTA
AIR LINES

See your Travel Agent or call Delta


in modules, high and low limit control, fail-safe voltage regulation, and temperature compensation. Source: **United Engineers,** 2139 S. Sheridan, Tulsa, Okla.

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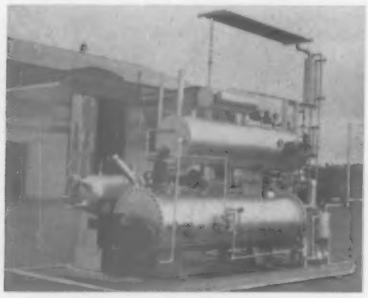

### Liquid-hydrocarbon stabilizing apparatus

A new liquid-hydrocarbon stabilizing apparatus has been developed which the maker claims can be economically applied to small liquid volumes. It uses the principle of a horizontal-transverse-flow type of rectifying column.

The unit is available in nominal stock sizes of 50, 100, 250, and 500 bbl. per day and larger sizes custom-designated. The maker reports that liquid recoveries have been increased as much as 33% on condensate production and that attractive payouts are expected with volumes down to 15 bbl. per day. Source: **American Tank & Steel Corp.,** P. O. Box 1110, Farmington, N. M., U.S.A.

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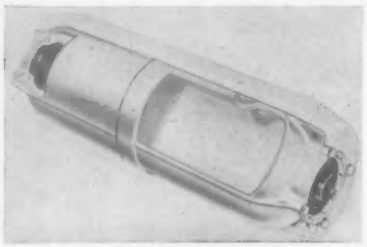


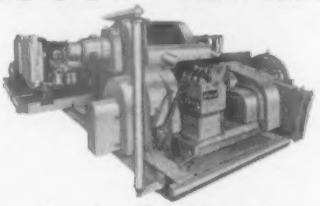
### Storage tank for chemicals

Acids, other corrosive liquids, or hot water can be stored in this Duo-Guard tank that features two shells: a chemically resistive, seamless plastic inner shell and a strong metal outer shell. The tank has a burst strength of 500 psi. and a volume of ½ cu. ft. Its over-all length is 24½ in., and its inside diameter is 7 in.

An aluminum outer shell gives the


**Don't fight it...**

**CHECK WILSON SUPER MOGUL "42" RIG**



• Priced well below any comparable competitive rig

Wilson

**WILSON MFG. CO., INC.**
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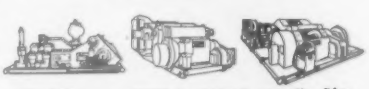
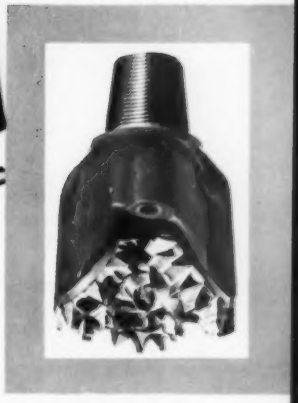
Winchmobiles Traveling Blocks Speedwinches



Slush Pumps 3000' to 25000' capacity Rigs

# BETTER HYDRAULICS are built into REED FLUSH-FLO JET BITS



***up to 50% more return area***

REED and ONLY REED offers you jet bits with FLUSH-FLO action and these six exclusive features.

1. Additional return circulation area for faster removal of cuttings.
2. Self cleaning action in the bit head as well as over the teeth.
3. Reduced bottom hole pressure that makes jets more effective.
4. Minimized hydrostatic pressure on formation when running bit in hole.
5. Minimized swabbing action when pulling bit.
6. Less hole enlargement in softer formations.

These six Reed exclusive advantages mean *dollars saved* for you. Let the Reed man who calls on you give you the full story. He can show you how Reed Y Bits actually give you more footage per dollar spent.

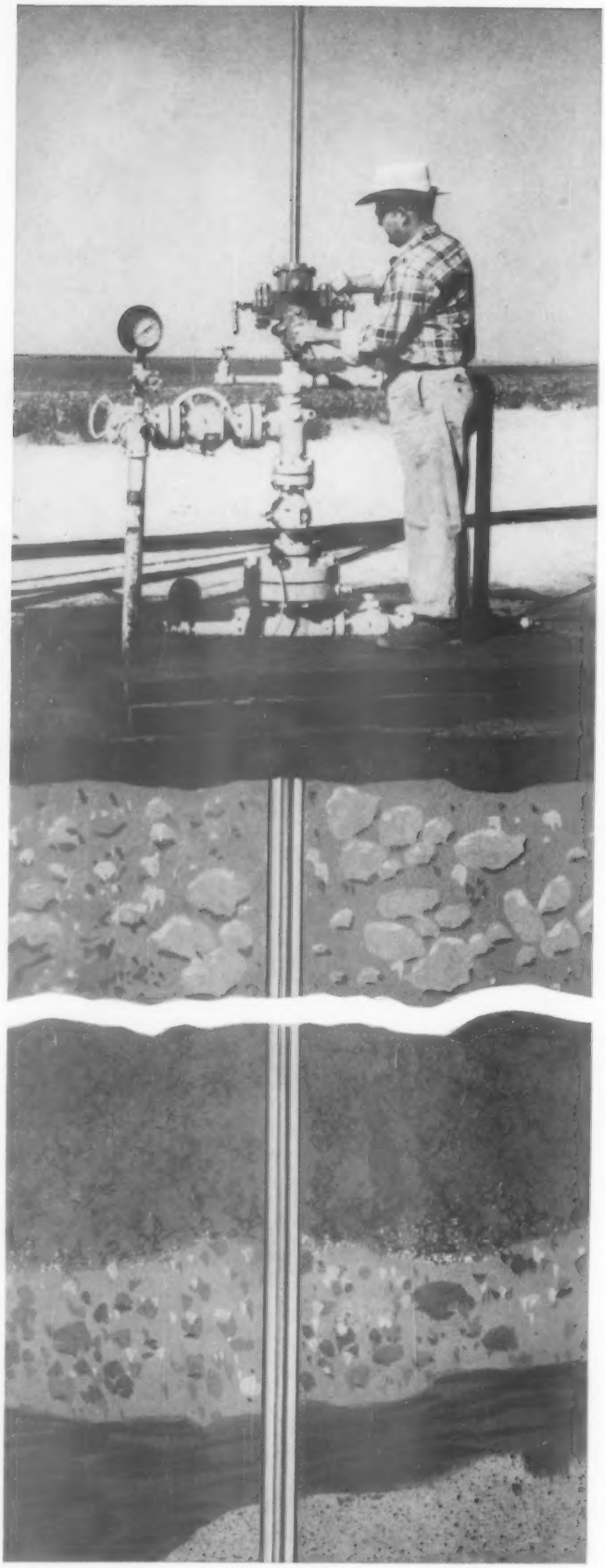
**REED**

**REED ROLLER BIT COMPANY**

Houston 1, Texas

Export Office: Time and Life Bldg., Suite 3744 Rockefeller Center, New York 20, N.Y.—Reed Roller Bit Company (Nederland) N. V., Rooseveltstraat 6, Leiden—Reed Roller Bit Company, Ltd., 4431 6th St. S.E., Calgary, Alberta.

# Nickel steel rods fight corrosion fatigue... pumping sour crudes at 80,000 psi



Corrosion fatigue was causing carbon steel sucker rods to fail at Cosden Petroleum's operation near Big Spring, Texas. They pump sour crudes with a chloride content of 30,000 ppm. 'Way down at 7,500 feet, stresses reach 75-80,000 psi.

**Outstanding resistance to corrosion fatigue** of AISI 4620 nickel alloy steel rods was the big reason why Cosden chose them to replace their carbon steel rods. Result? After three years' service, the nickel steel rods are still in excellent condition. Cosden expects many more years of trouble-free service from them.

**For cost-saving heavy-duty pumping** in corrosive conditions, remember this when you order sucker rods. AISI 4620 nickel alloy steel sucker rods provide—

- High mechanical properties, assuring stiffness needed in long strings and enabling rods to withstand the high stresses of deep-well pumping.
- Good staying power in a wide range of corrosives.

Great strength, ductility, toughness, corrosion resistance — AISI 4620 combines them all to stand up to high cyclic stresses and sour crude corrosion fatigue.

**Nickel alloy steels give outstanding performance** in other petroleum-production equipment. For drill pipe, hole reamers, in fishing taps and slip liners, in pumps and sucker-rod couplings — nickel alloy steel parts are your best insurance against equipment failure.

**THE INTERNATIONAL NICKEL COMPANY, INC.**

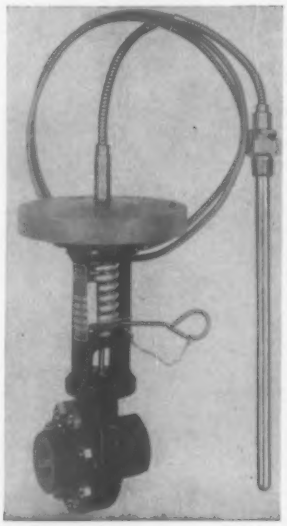
67 Wall Street INCO New York 5, N. Y.

**INCO NICKEL**

NICKEL MAKES STEEL PERFORM BETTER LONGER

tank strength. Working temperatures of the tank range up to 225° F. Construction features include a symmetrical top and bottom, 4-in. opening at each end, and ¾-in. end connections. Source: **Bruner Corp.,** 4767 N. 32nd., Milwauke 9, Wis., U.S.A.

●



## Self-operated temperature regulator available

The body and all wetted parts on this temperature regulator are made of stainless steel to handle chemical application sand corrosive or erosive conditions.

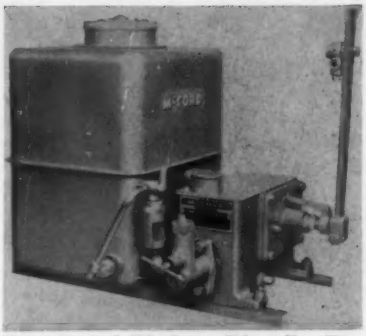
It comes in sizes from ¼ to 1¼ in. The sliding gate type of seats have linear characteristics. The seats are a self-cleaning and self-lapping type which reportedly provide tight shutoff. The thermal system can be removed so the range can be changed in the field. Source: **OPW-Jordan Corp.,** 6013 Wiehe Rd., Cincinnati 13, Ohio, U.S.A.

●

## Chemical pump for crude treating

Reliable operation and a relatively high chemical capacity of 5 gal. are featured in this latest chemical pump. The Type C pump can be used for treating crude oil by the use of various emulsion-breaking compounds and paraffin solvents.

The chemical tank is made of stamped sheet metal and has a large opening with a bayonet type of filler opening. Source: **McCord Corp.,**

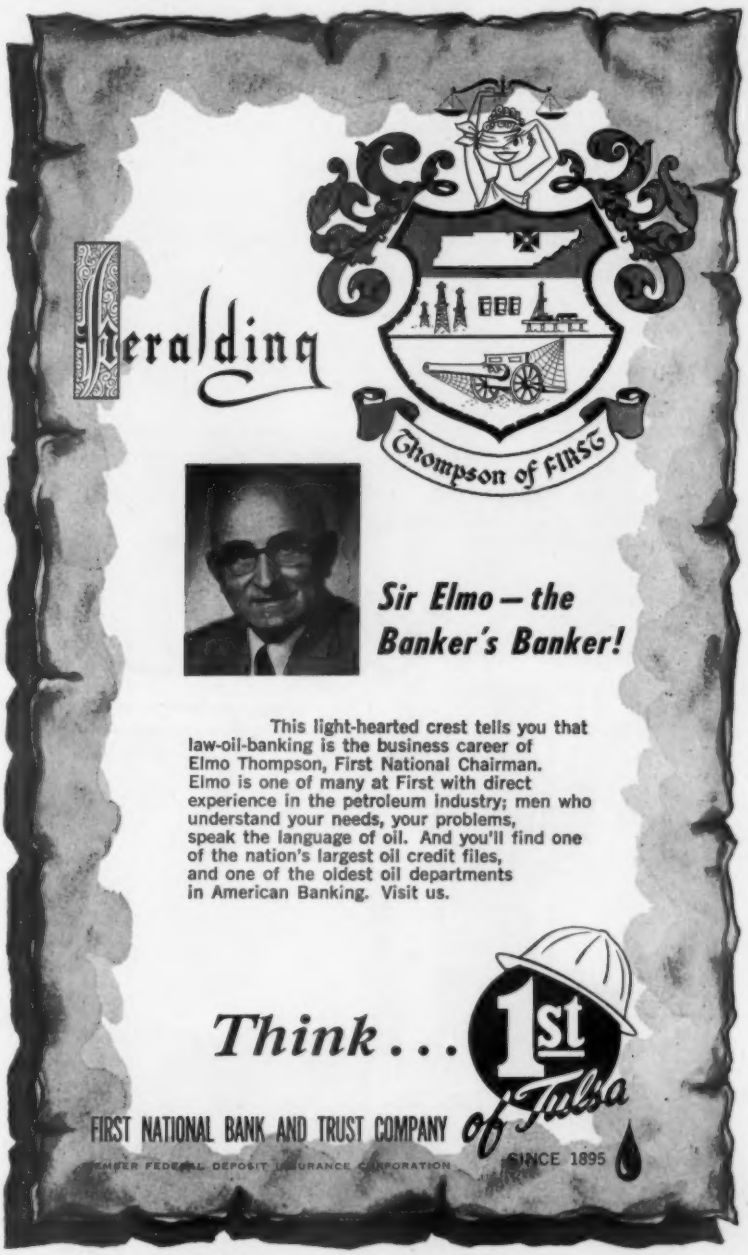


East Grand Blvd. at Riopelle, Detroit 11, Mich., U.S.A.

## Coating releases gas to put out fires

When flames or excessive heat attack a new fire-retardant coating recently developed, the coating decomposes. As it does this, it releases a quantity of incombustible gas and a film bubbles and foams to form a thick layer of insulating foam.

As described by the developer, the Flame-Tec coating forms a swelling layer of foam that insulates the underlying material from heat and prevents it from reaching an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SINCE 1895

*Illinois Power reports...*

# How to keep pressure up when demand goes up

To meet growing gas demands and maintain pressures, Illinois Power Company is expanding its underground storage and its compression facilities. It is now building a new storage station and has just completed additions to two compressor stations.

The Illinois Power system will then comprise one booster station and three storage stations. All are equipped with Cooper-Bessemer FM Compressors... the first units purchased in 1957 and the latest to be installed this year. Two stations are automated and remotely controlled with Cooper-Bessemer En-Tronic systems. Three of the stations were engineered and built by Stearns-Roger Manufacturing Co.

Find out how Cooper-Bessemer engineers can assist you in planning new or modernized compression and power facilities. Call the nearest office.

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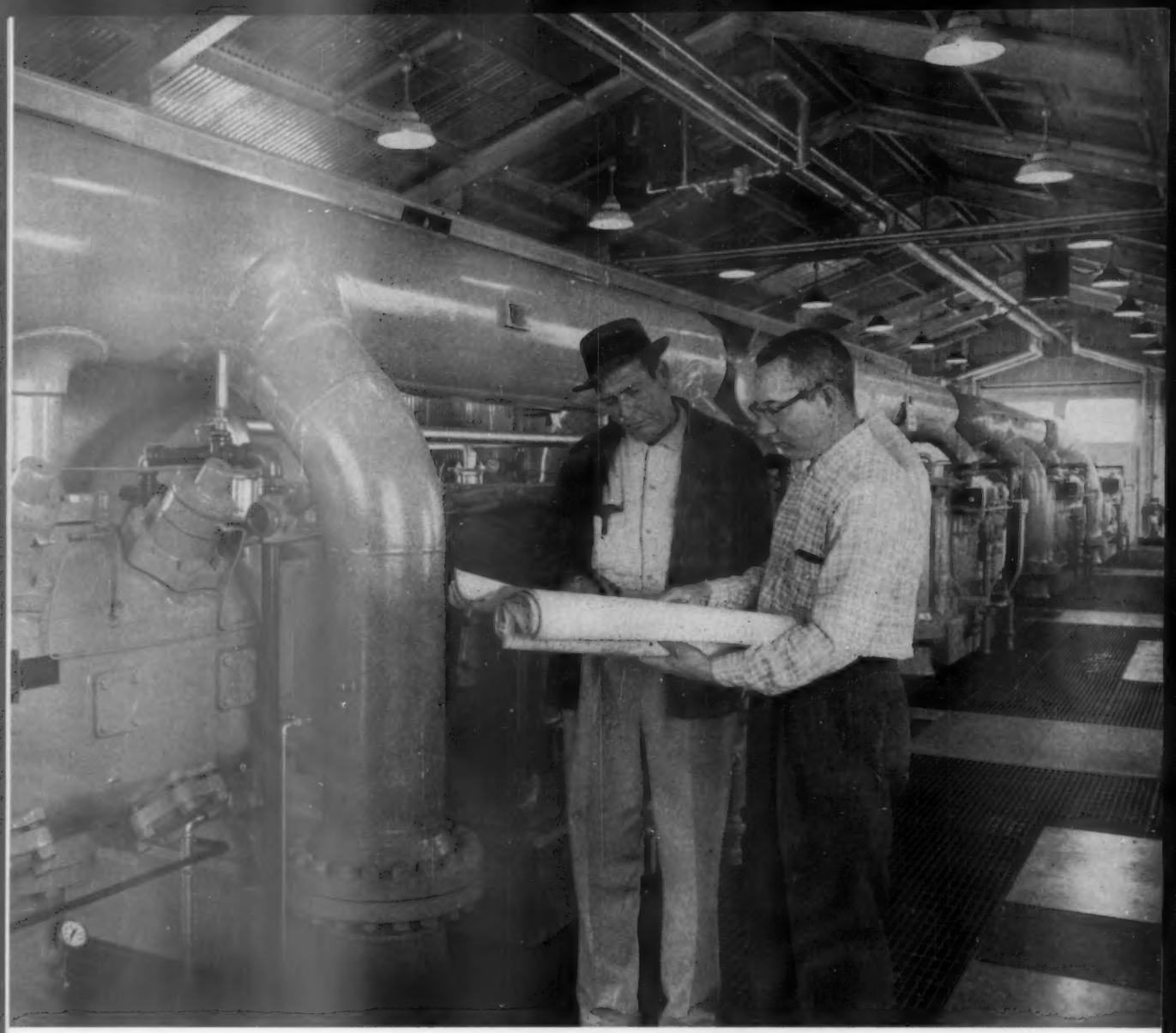
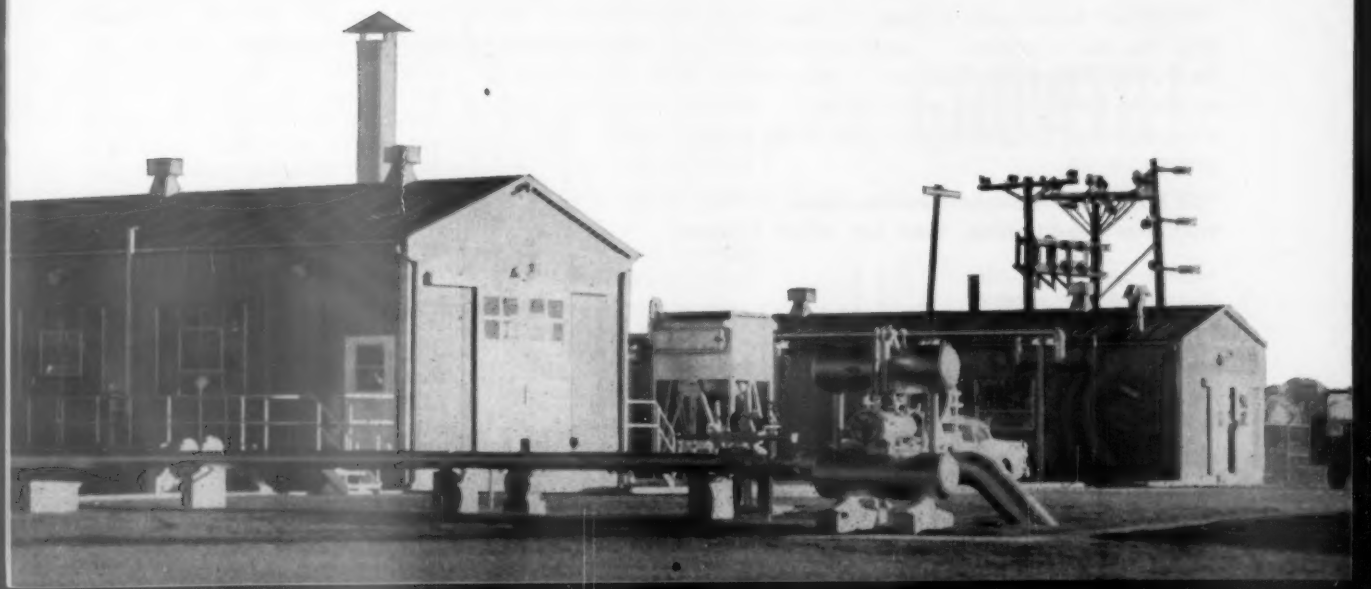


W. M. May, Freeburg Station Superintendent, and K. W. Robertson, Gas Engineer of Illinois Power, discuss recent expansion of Freeburg Station. Its four 700 hp Cooper-Bessemer FM Compressors pump 36,000 mcf/day at 65 psi suction and 260 psi discharge.



ignition temperature. In the case of metals, the coating, by insulating the metal, keeps it from deforming and weakening. In addition, the incombustible gases evolved by the coating virtually snuff out the flames.

The coatings are being produced in a complete line of maintenance coatings that can be applied by brush, spray, or roller on new work and over old paint. Source: **Kansas Paint & Color Co.,** 132 N. Mosley, Wichita, Kans., U.S.A.

## Phone conversations amplified

BOTH HANDS CAN BE FREE with a new device, called a Speak-R-Phone, that amplifies two-way telephone conversations through a loud speaker. The unit is compact and self-contained. The maker claims it operates over a year on a small battery.

Requiring no wires or other connections to the telephone, the device turns on automatically when the telephone handset is placed on it. Volume is adjustable and may be turned up for use as a conference telephone. Source: **Varicon Corp.,** 1415 3rd Ave., Seattle, Wash., U.S.A.

•

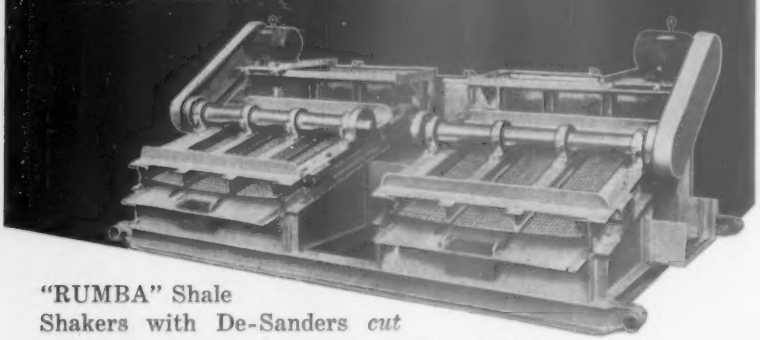
## Level switch protects pumps

Costly damages to the bearings and packing glands of oil or water submersible pumps may be prevented with a new switch now being produced. The device senses liquid flow by measurement of discharge pressure integrated with time. The switch will electrically shut off the pump motor in the event that low discharge pressure occurs over a predetermined length of time.

At frequent intervals, automatic cycling of the pump will be initiated, until the required conditions are continuously satisfied by the flow capacity of a well. The switch will operate on either a 110 or a 220-volt, 60-c.p.s. power supply and will operate directly a 110, 220, or 440-volt electric pump motor with a rating up to 25 amp.

The unit is connected to the discharge line by a ¼-in. NPT fitting and may be directly mounted on the pipe or remotely located in the oil-well control box. Source: **American Machine & Metals, Inc., United States Gage Div.,** Sellersville, Pa., U.S.A.


**"RUMBA", THE MOST EFFECTIVE COST REDUCER IN YOUR MUD SYSTEM– LOW INITIAL COST . . . LOW MAINTENANCE COST . . . RECLAIMS MORE MUD . . . SAVES PUMPS AND VALVES . . . and IT WILL OUTLAST YOUR RIG!**



"RUMBA" Shale Shakers with De-Sanders *cut* drilling mud costs by removing more cuttings and sand than any other unit; thus, fewer mud treatments, less conditioning. "RUMBA's" efficient removal of abrasives *cuts* repair costs . . . makes pumps, pistons, liners and valves last longer.

"RUMBA" handles more mud . . . distributes fluid over the entire screen . . . only shaker equipped with both de-sander and sample catcher . . . only shaker with underslung screen to stop whipping and flexing . . . provides effective separation at highest rate of flow from largest slush pumps in use.

**"RUMBA" Shale Shakers reclaim more drilling fluid, with less conditioning, than any other method!**

**"RUMBA"** Shale Shakers with De-Sander and **"FLOLIGHT"** Derrick Lighting Systems are sold through supply stores everywhere.

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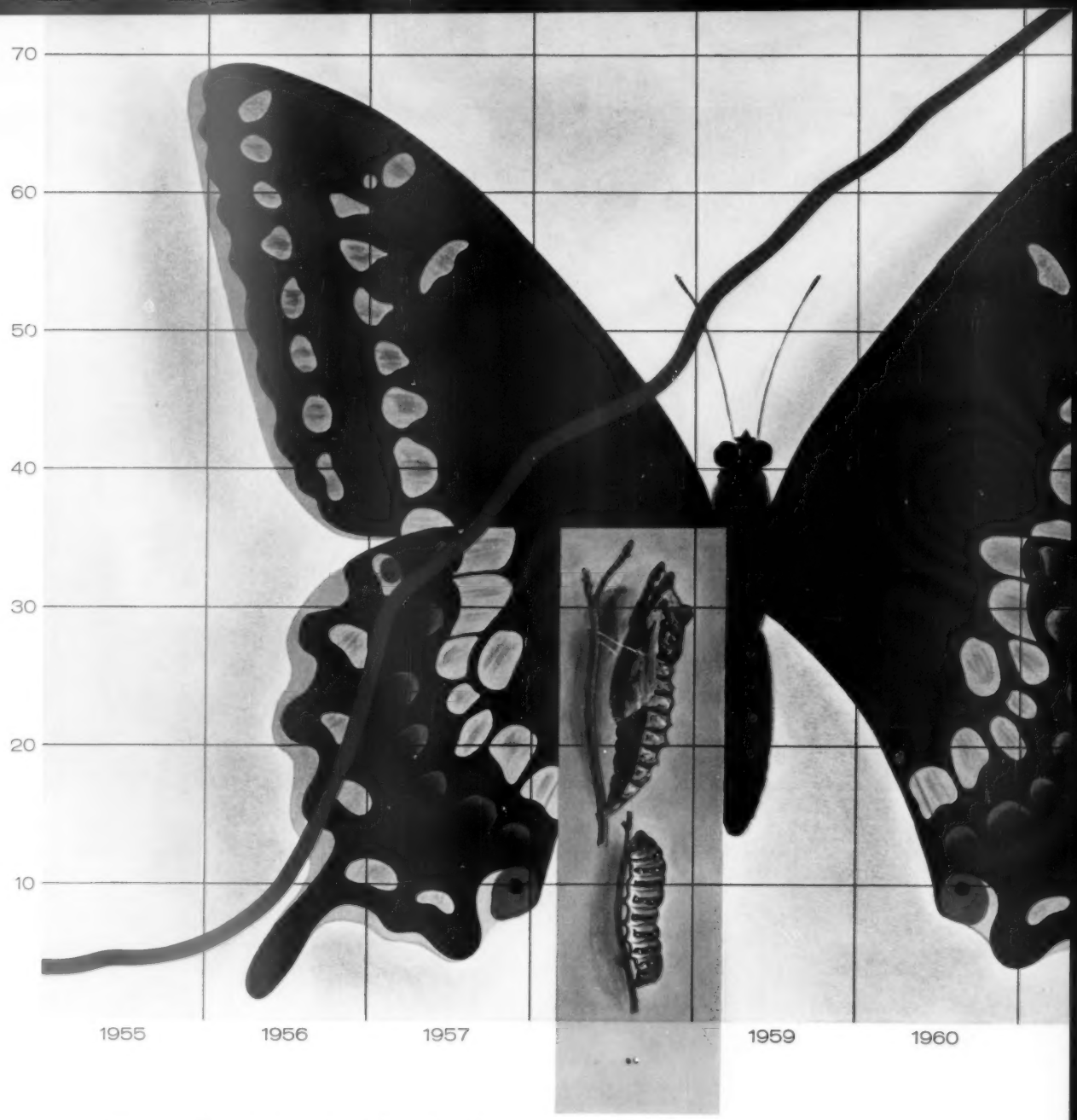


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# GROWTH!

Schlumberger is proud of the petroleum industry's acceptance of Induction-Electrical Logging. This service was developed and introduced by Schlumberger only five years ago. The impressive growth is a testimonial for this broadly applicable service.

Most operators have proved the two-fold superiority of the Induction-Electrical log . . . more reliable identification of oil and gas zones and more accurate evaluation of productivity.

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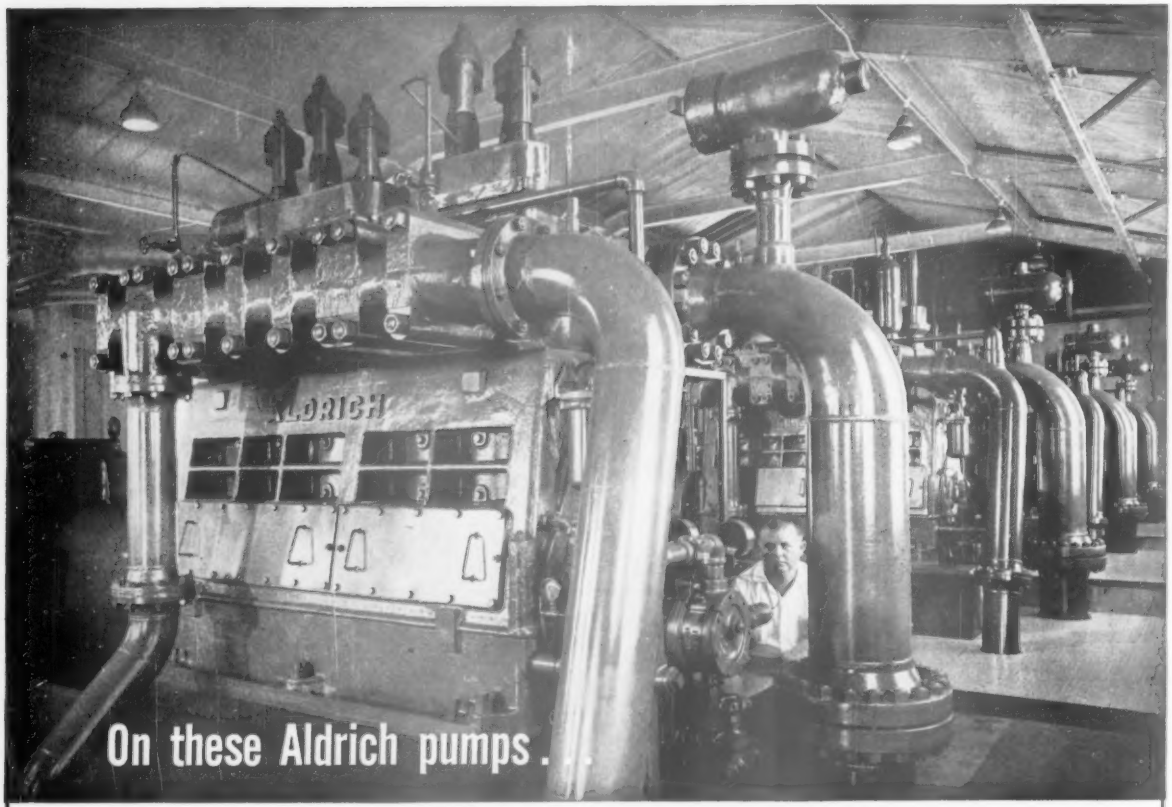
THE EYES OF THE OIL INDUSTRY




# GULF OIL REPORTS 6 YEARS OF CONTINUOUS SERVICE WITH MINIMUM MAINTENANCE

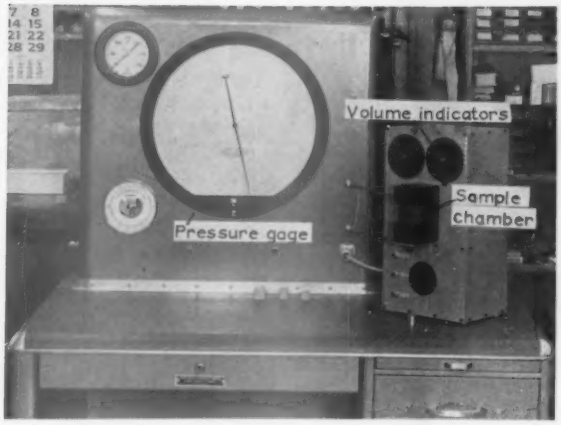
FIELD REPORT

FLOOD: Goldsmith-San Andres Unit
OPERATOR: Gulf Oil Corporation
PUMPS: 4 Aldrich Quintuplex
FLOODING STARTED: October, 1954
EXPERIENCE TO DATE:

After six years, three pumps operate 24 hours a day, delivering some 54,000 bbl/day of sour oil field brine at 750 to 800 psi. Station designed for automatic operation. All maintenance handled by one man during eight-hour work day.

Field Parts stock available in Houston, Odessa, Alice and Wichita Falls, Texas; Casper, Wyo.; Hobbs, N.M.; Carmi, Ill.; Charleston, W. Va., Tulsa, Okla.; Los Angeles, Calif.; Calgary, Ontario. For further information write the ALDRICH PUMP COMPANY, 9 Gordon Street, Allentown, Pa.

*the tough pumping problems go to* ALDRICH




# Core volume measured fast

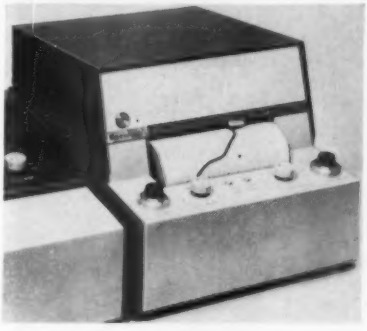
SOLID CONTENTS of porous, irregular, or granular materials such as oil and gas-well core samples can be measured at rates up to 100 per hour to an accuracy of 0.01 cc. with a new volume meter, called the Exline Rock Volometer. To measure the solid content of a core sample, the operator places the core sample in a chamber which is then filled with helium to a predetermined pressure. A piston in a cylinder connected to the sample chamber is then retracted by a ball screw and nut combination to reduce the chamber pressure to a lower predetermined pressure. The solid volume is then read on two dials mounted on the face.

A highly accurate gage equipped with a stainless-steel bourdon tube and a temperature compensator indicates the correct starting and stopping points. A barometer on the front panel indicates barometric pressure.

The full cycle comprises six steps in sequence. Three sample cups are provided to accept plugs. The three sample cups handle, respectively, core samples measuring ¾ in. in diameter by 1 in. high, ¾ in. sq. by ¾ in. high, and 1′ in. in diameter by 1 in. high. A calibrating plug with a volume of 6½ cc. comes with the volume meter. Source: **Exline Engineering Co.,** 107 W. Second, Tulsa, Okla., U.S.A.

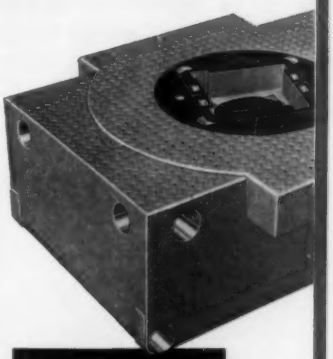
# Programer to reduce sample-analysis time

When used with most gas chromatographs, this Thermotrac temperature programer can shorten sample-analysis time, the maker says. It permits analysis of samples containing components with a wide range of boiling points without reducing the resolution of the low-boiling-point components which appear in the early stages of the analysis, according to the maker.



In using the instrument, the operator traces the desired temperature program with a strip of black tape or with India ink on a Mylar sheet. The program sheet is then placed on a rotating drum. The slope of the black line on the sheet determines the rate of rise over the desired span, the zero potentiometer determines the starting temperature, and the span potentiometer determines the heat rise during the program. Source: **Beckman Instruments, Inc.,** 2500 Fullerton Rd., Fullerton, Calif., U.S.A.

CALL
MID-CONTINENT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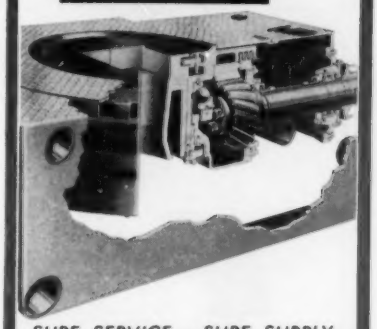
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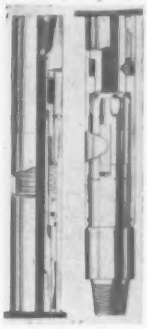
## Fishing jar serves three purposes

The advantages of a straight-pull hydraulic jar, a straight-pull mechanical jar, and the controlled releasing action of a positive safety joint are offered by a new type of fishing jar which has been developed. Called a Hydraulic Trip jar safety joint, the tool is used as a straight-pull hydraulic jar, with the force of the blow controlled at the surface.



The pull acts through a hydraulic chamber built into the tool and causes the desired blow to be struck as soon as enough fluid gas passes through an orifice in the tool. Normally, this takes only a few seconds between the time the stretch is taken and the blow is delivered. To reset the tool, the operator merely lowers the string. Source: **Shaffer Tool Works,** Brea, Calif., U.S.A.

•

## Transmitters for citizens band

THREE MODELS of a new line of transmitters are now available for operation in the citizens-band radio frequencies. The three base-station transmitters include a Model T-2700 unit with a built-in power supply that can be operated independent of the makers R-2700 receiver, a Model T-2700-S unit that derives its power from the R-2700 unit, and a Model S-Nine unit especially designed to minimize the effects of heavy traffic on the citizens-band channels.

Features claimed for the three transmitters include a highly efficient pi network circuitry for high transfer of energy to the antenna, self-contained audio circuitry designed to supply full modulation, a neon output "on the air" indicator, high-quality ceramic microphones

MARTIN RUBBER & DUCK RINGS give excellent life in dirty abrasive fluids . . . high or low gravity . . . much or little water . . . shallow or deep wells. They last for years in the easier pumping wells. Replacement rings cost comparatively little.

MARTIN PLUNGER BODIES, precision grooved, drilled and threaded (no underneath fluid passage), usually last for years. Tube or barrel costs are often cut in half.

The replaceable SYNTHETIC RUBBER GUIDES in MARTIN CAGES last longer than any metal, and the cushioning of the ball increases your ball & seat life. Results are often truly amazing. (Patent No. 2,591,174)

*Write for our new catalog or see it in the Composite (24th Edition). All products sold thru supply companies.*

JOHN N. MARTIN
*Manufacturer*
W. BRADY STREET • TULSA, OKLAHOMA




and desk stand, and six crystal-controlled transmit channels selectable from the front panel. Source: **Browning Laboratories, Inc.,** 100 Union Ave., Laconia, N. H., U.S.A.

•

## File for maps, drawings

Forty cardboard tubes in a new map file offer a way to store rolled maps, drawings, and prints of virtually any size. The Scottie map-bin file comprises a heavy-gage steel bin that measures 22 by 9 by 27⅜ in. high with a baked-enamel finish and fitted with the 40 cardboard tubes. The tubes measure 36 in. long with a 2-in. diameter.

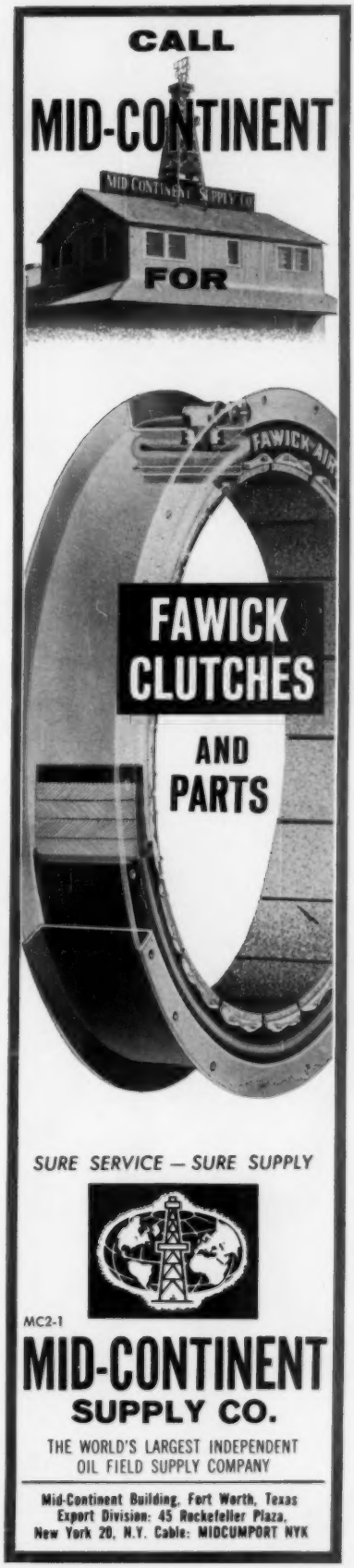
A rubber bumper around the file protects furniture, and plastic cover keeps dust out of the file. Source: **Scott-Rice Co.,** 610 S. Main, Tulsa 19, Okla., U.S.A.

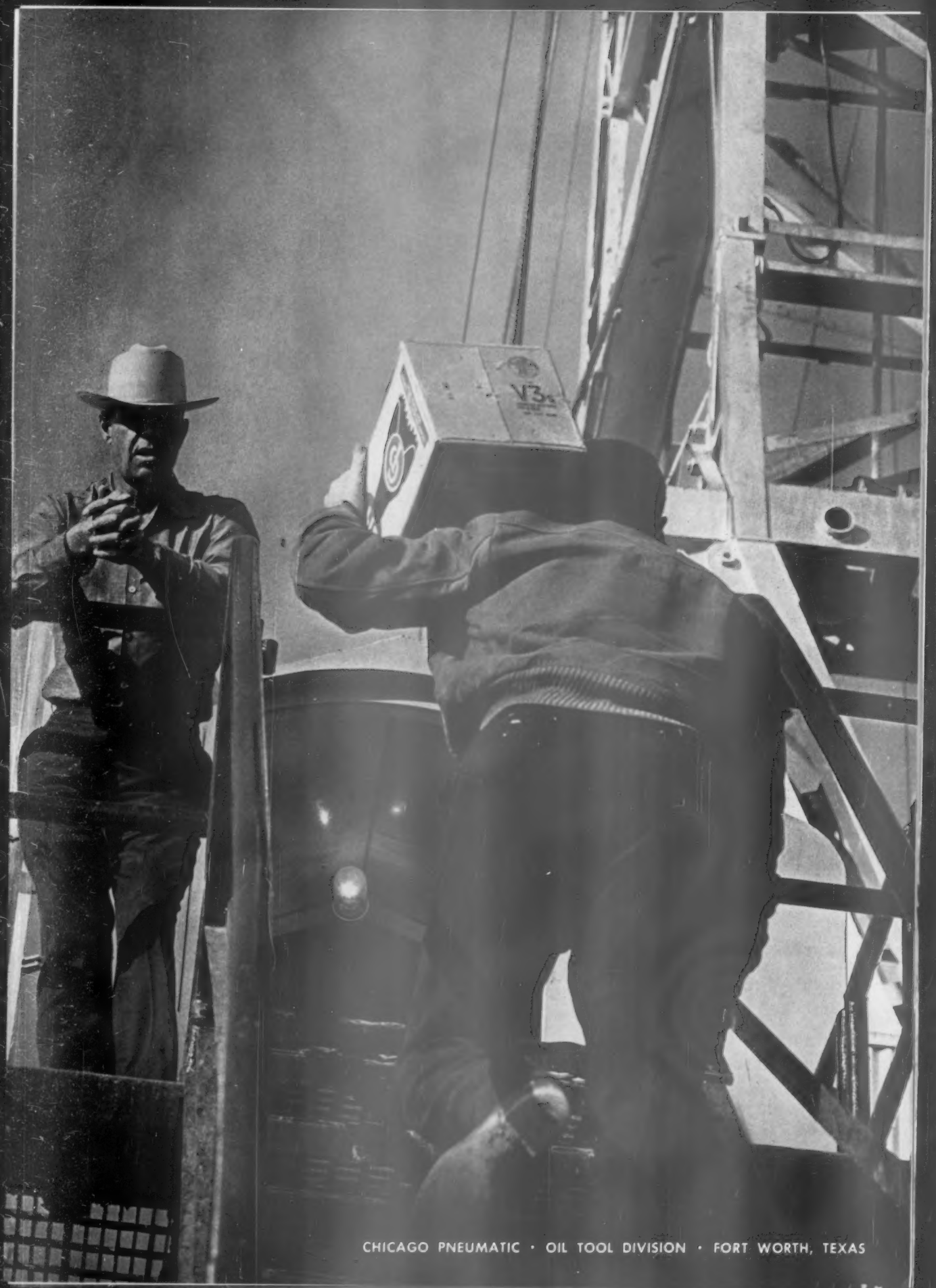
•

## Weld fitting adapts easily

A special weld ring on this Weld Couplet permits it to adapt to any pipe or vessel curvature by simply adjusting the height position of the Couplet in the opening when welding, the maker says. This feature is claimed to assure correct positioning and alignment, a stronger weld without distortion, and no inside "icicles" of welding material.

The fitting comes in both threaded and socket-weld types in sizes from ¼ to 2 in. in carbon steel conforming to ASTM specifications. Source: **Henry Vogt Machine Co.,** P. O. Box 1918, Louisville 1, Ky., U.S.A.

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Let him work with you to help keep your drilling program on schedule.

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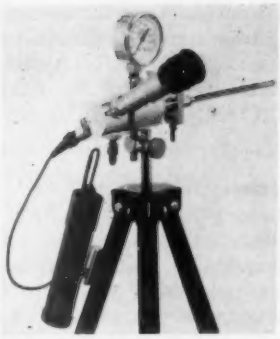

## Optical system for dew-point detector makes readings accurate

A self-contained light source on a new dew-point detector attachment lets you take dew points at night or under any adverse weather. Its 16X magnification lets you readily tell the difference between hydrocarbon and water dew points and between water dew and ice points, the maker reports.

Called a Dewtector, the instrument is lightweight, easy to carry, and simple to attach. It attaches directly to newer Bureau of Mines dew-point detectors without alteration. Source: **UGC Instruments,** P. O. Box 1407, Shreveport, La., U.S.A.

•

## Machine turns gas energy into work

The energy contained in hot gases can be converted into work and relatively warm gases can be cooled to subzero temperatures with a new machine, called a turboexpander, now on the market. As described by the manufacturer, the machine is designed to cool gases as efficiently and as compactly as possible, with complete safety.

Components of the machine include a gas compressor or power absorber and the turbine in which, for example, gases at a pressure of 100 psi. and a temperature of 100° F. can be cooled to −60° F. and 20 psi. The turbine mounts at one end of a shaft and the blower or compressor mounts at the other end. This assembly is supported in bearings carried by a pedestal. An underframe contains the lubricating and control equipment, and supports the insulation box and instrument panel. Source: **Ruston & Hornsby, Ltd.,** P. O. Box 2, Lincoln, England.


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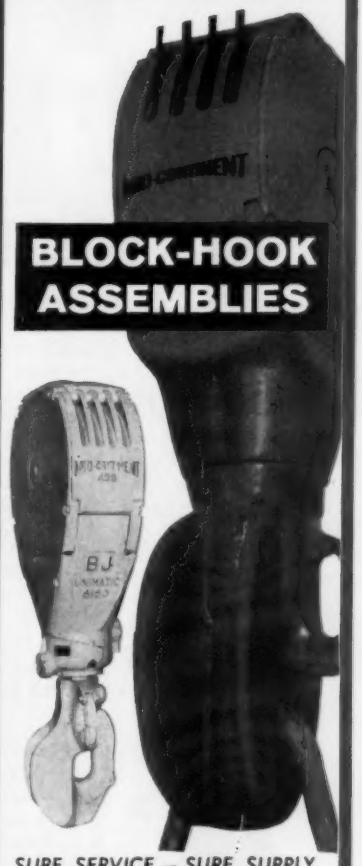

BLOCK-HOOK ASSEMBLIES

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## What's NEW

... in literature

### Instruments for measuring

Twelve-page Bulletin 10-1.3 features various devices used to measure high-voltage breakdown, dielectric strength, insulation resistance, ground resistance, and earth resistance. The new publication includes descriptions and illustrations of high-voltage power supplies, automated test systems, and special instruments for laboratory, production, and maintenance. Source: **Associated Research, Inc.,** 3758 W. Belmont Ave., Chicago 18, Ill., U.S.A.

### Hollow-spindle lathes

These lathes, for industrial use whenever a large opening in a spindle is required, come in sizes with spindle holes from 3½ to 19½-in. in diameter. A new four-page bulletin offers photographs, special features, and a full page of specifications. Source: **Lehmann - Brandes Machine Co.,** Chouteau at Grand, St. Louis 3, Mo., U.S.A.

### Lubricating equipment

Bulletin X-135 discusses oil cups, chain oilers, oiling systems, dispensers, liquid-level gages, and valves in an eight-page form. Included is general background information on the importance of selecting the right lubricator, followed by more specific data on the benefits of individual lubricators. Numerous line drawings along with an inserted two-page price list are included. Source: **Oil-Rite Corp.,** 2318 Waldo Blvd., Manitowoc, Wis., U.S.A.

### Automation and control

A newly published brochure, free upon request, describes various telemetering, remote control, data processing, and data - transmitting systems. It includes information on automatic electro - mechanical systems, errorless transmission systems, and standardized automation components. Source: **Hammarlund Automation Div., Telechrome Mfg. Corp.,** Amityville, L. I., N. Y., U.S.A.

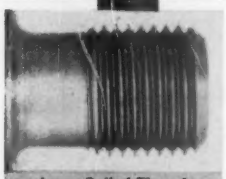
### Automatic controls

Illustrated and described are fully automatic engine controls in two series, along with overspeed governors and speed-sensitive switches, d.c. solenoids, and miscellaneous engine accessories. Four-page Catalog 6 offers photographs, obtainable sizes, and advantages of the various controls. Each instrument carries an additional bulletin number from which more specific information can be obtained. Source: **Synchro-Start Products, Inc.,** 8151 N. Ridgeway Ave., Skokie, Ill., U.S.A.

### Balanced freight loads

Trailer load equalizers, detailed in a new four-page literature piece, are said to increase payload on every trip, thereby earn extra profit through the year. An automatic locking preselector is said to slide easily and to insure fast trailer inter-

API Cut Thread
Most susceptible to fatigue is thread root area, where notch effect exists.



Jones Rolled Thread
Mirror-like surface aids application of make-up torque to pre-stress joint.

...another Jones First

JONES

Rolled-Thread Undercut Pin

*Greater Strength–Easier Make-Up*

Rolled threads, made by cold working or displacing the metal into the thread form, are stronger at the very point where most cut-thread pin failures originate. Steel fibers and grain are rearranged to follow the thread contour, providing a dense structure at the critical thread root . . . added strength where it is needed most. Additional fatigue resistance is obtained by undercutting the pin shank, thereby eliminating the run-out thread and improving the elasticity of the joint. The superior finish and gauge tolerances attained in Jones rolled-thread sucker rod pins reduce friction and make possible greater prestressing of the joint with equal torque.

**Ask your Jones representative for complete information on this new Jones development.**

THE S. M. JONES COMPANY

Division of Buffalo Eclipse Corporation
General Office and Factory: TOLEDO, OHIO
Sales Office: Enterprise Building, TULSA, OKLAHOMA
Export Department: The S. M. Jones Company

140

change with reduced time and labor costs. Source: **Binkley Co.,** Warrenton, Mo., U.S.A.

### Microwave-tower checks for inspection and maintenance

The check list consists of a handy, pocket-size booklet which emphasizes what should be checked and how often. It points out what to look for and how to repair or replace parts. A routine maintenance program is also recommended and outlined. Source: **Tower Construction Co.,** 2700 Hawkeye Dr., Sioux City, Iowa, U.S.A.

### High-pressure-field gas regulators

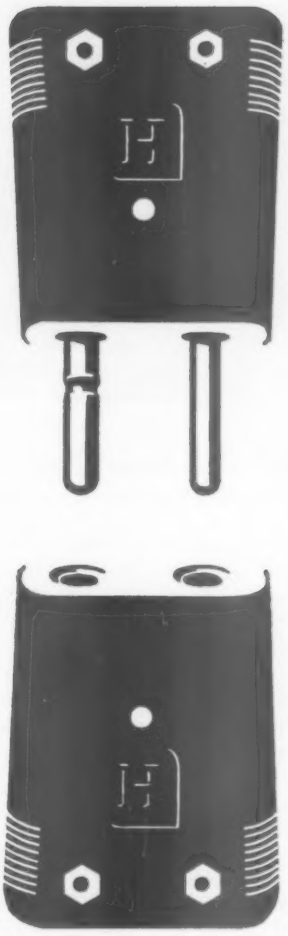
An eight-page booklet, which is part of a current catalog revision, contains data on high pressure, intermediate, and field regulators. Models include Series 8250, 8525, and 8550 gas regulators. All are springloaded for psi.-to-psi. regulation. Source: **Reynolds Regulator Co,.** Box 1, Shreveport, La., U.S.A.

### Hard surfacing for steel

H-F Thermospray hard surfacing is a special method of applying an extremely hard surface to steel so that wear caused by continuous metal-to-metal friction will be low. A four-page literature piece, just made available, presents informative text, advantages, and a full page of specification tables. Source: **Harbison-Fischer Mfg. Co.,** Box 2477, Fort Worth, Tex., U.S.A.

### Slim-hole subsurface pumps

Pumps described and illustrated are for 1¼, 1½, and 1¾-in. nominal i.d. tubing. The literature details conventional pump assemblies including tubing size and pump bore, type of pump, and material used in barrel tube, plunger, cages, and balls and seats. Included is stroke-length data, seating shoe, nipple and ring specifications, and slim-hole pumps and tubular specifications. Source: **Continental-Emsco Co.,** Box 359, Dallas 21, Tex., U.S.A.

QuiK-Konnect
PLUGS AND JACKS

New Honeywell QuiK-Konnect Plug and Jack Assemblies provide fast, foolproof connection of thermocouples to extension wire, and thermocouple extension wire to instruments. Inserts of different diameter positive and negative poles insure correct polarity every time. Inserts are easily removed for field calibration change or replacement, and can be furnished in different metals to match thermocouple alloy. Honeywell Quik-Konnect Accessories include identos, cable clamps, and tube adapters.

Get complete details from your nearby Honeywell field engineer, or write today for Specification Sheet FS 005-3. Minneapolis-Honeywell, Wayne and Windrim Avenues, Philadelphia 44, Pa. In Canada, Honeywell Controls, Ltd., Toronto 17, Ontario.

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# ▶▶▶ Equipment Men Notes

### Dr. N. A. Schuster becomes

Dr. N. A. Schuster

. . . vice president — technique of Schlumberger Well Surveying Corp., in which post he will supervise all research and engineering activities of the corporation. He succeeds A. Blanchard who is retiring in June.

Dr. Schuster will make his headquarters in Ridgefield, Conn., site of Schlumberger's East Coast research facilities. For the past 3 years he has served as manager of development engineering at Houston.

### Grove Valve & Regulator names

. . . George F. Rogala as assistant secretary of the company, it was announced by John W. Collins, president. Grove Valve is a subsidiary of Walworth Co. Prior to this appointment, Rogala was chief accountant. He has been with Grove for 15 years.

G. F. Rogala

### Jones & Laughlin Supply names

. . . three district store managers and two store managers, according to A. G. Bastian, manager of field operations. O. W. Shepherd, store manager at Oklahoma City, has become store manager for J&L's Central Oklahoma district at Oklahoma City. C. B. Cress, store manager for the Perry, Okla. store, takes over as store manager at Wichita Falls for the North Texas - southern Oklahoma district. F. R. DeWitt, store manager supervisor at Tulsa, is now store manager at Tulsa for the eastern Oklahoma district.

Newly appointed store managers are A. J. Chelf, Perry, Okla., and J. A. Baker, Trenton, Neb.

### W. C. Norris adds to sales force

. . . in the persons of G. W. (Gerry) Russell and Charles Sonnier. Russell has been assigned to the company's West Texas sales division and will locate in Abilene, Tex. He has been a practicing engineer with several oil producers during the past 6 years. Sonnier, assigned to the Gulf Coast division, will headquarter in New Iberia, La. Prior to joining W. C. Norris, Sonnier was associated with Murray-Brooks, Inc.

### H. T. Larmore is appointed

. . . assistant general manager of Allis-Chalmers Construction Machinery Division. He has been general products manager of the division since August 1960. Larmore joined Allis-Chalmers in 1936, was named assistant construction machinery service manager in 1942, and service manager in 1944. The following year he became crawler tractor and allied equipment sales manager, the post he held until last August.

### Lone Star Steel Co. accepts

. . . a proposal of Equitable Life Assurance Society to lend the Dallas company $40 million with which to retire its long-term government debt. According to Lone Star's president, E. B. Germany, the loan will enable the company to pay off its debt of $32,653,000 to the government, thereby removing a number of restrictions imposed by the loan agreement with respect to capital expansions and cash dividends. Remaining funds will be used for expansion.

### Richard H. Rainey is manager

. . . of U. S. and Canadian operations for Geophysical Service, Inc. He has been with GSI since 1947 and has been assistant to the vice president, Eastern Hemisphere, since last January.

At the same time, GSI President Robert C. Dunlap, Jr. announced the resignation of Neil W. Mann as vice president in charge of U. S. and Canadian operations. Mann had been with the company 27 years.

### Smith Tool Co. honors three

. . . veteran employes with 25-year-service pins. Honored were Manuel L. McAlister, vice president of manufacturing; Arthur S. Marshall, vice president of sales; and Raleigh Allen, general foreman of the assembly department. The pins were presented by Kenneth H. Swart, president of Smith Tool, a division of Smith Industries International, Inc.

### James L. Miller is appointed

J. L. Miller

. . . district manager for Oklahoma and Arkansas by Owatonna Tool Co., Owatonna, Minn. The announcement was made by S. L. Richmond, sales manager of the Tools & Equipment Division. Miller previously served as a sales representative for Bonney Tool Co.

**MANAGERS** of Security Engineering Division gathered at Dallas this month to review company progress and hear plans for future development. A division of Dresser Industries, Inc., Security manufactures rock bits for drilling. Attending the meeting were, from left: J. E. Donohue, W. B. Thomas, Chester Frazier, Don Davenport, John Smith, Ralph Hughes, M. L. Talbert, Jim Kelley, Dick King, K. L. Byerly, Jim Dirks, Frank Watts, President J. C. Helies, Frank Leonis, John Millet, W. C. Gray, Vernon Loveall, Miller Ekas, Joe Mitchell, Mack Harlan, John Schween, and Bob Cannon.

**ADVERTISING AWARD** is accepted by John Maher, left, president of Reed Roller Bit Co., from Earl Rives, president of the firm's advertising agency, Rives, Dyke & Co., Inc. The award, a "first place" for the Reed 1960 advertising campaign, cited the Houston firm's year-long program as "the most effective use of advertising in the industrial field." Previous Associated Business Publications competitions have granted "merit awards" to firms in the South, including Rives, Dyke clients Schlumberger Well Surveying Corp. and Mission Mfg. Co. But the Reed award is the first time ABP has awarded its first place citation to any firm or agency in the South or Southwest.

### William McLaughlin to manage

W. R. McLaughlin

... the newly created new products division of Rockwell Mfg. Co.'s Meter & Valve Division. McLaughlin, who was southwestern regional sales manager for the Meter & Valve Division, will headquarter in Dallas where he will be responsible for coordination of research and development, field testing, production, and sales promotion for all new division products.

Three other changes resulting from McLaughlin's new job involve: James Sells, southwestern regional manager; William Henry, Houston district manager of the division replacing Sells; and Pat Luckett, replacing Henry as Houston district manager, Municipal & Utility Division.

### Control-system agreement made

... by TRW Computers Co., a division of Thompson Ramo Wooldridge Inc., and Swartwout Division of Crane Co., whereby the companies will provide complete automatic control systems to the chemical, petrochemical, and petroleum industries. The agreement makes complementary equipment and technical resources of each company available to the other.

### Hills-McCanna Co. appoints

... Oil Capital Supply Co., Tulsa, and U. S. Supply Co., Kansas City, as stocking distributors for diaphragm and ball valves. The announcement was made by R. F. Dauenhauer, distributor sales manager of the Carpentersville, Ill., firm.

### Continental-Emsco creates job

P. J. Allen

... and promotes 12 new store managers. Perry Jack Allen, former division merchandise manager in Edmonton, Alta., has been named manager of Green Triangle product sales. He joined the company in 1952 as a general clerk in the Dallas office.

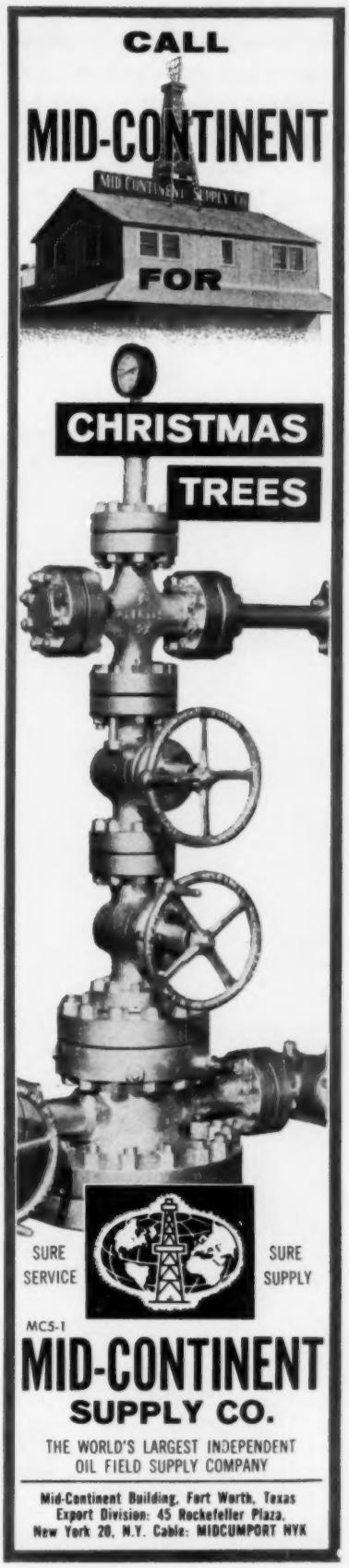
The following have been promoted to store-manager positions: Ronald Bourg, Morgan City; Edmund Specht, Longview; Jake Massey, McAllen; William Josting, Natchez; Ed Brewer, Winnsboro; William Knapp, Bakersfield; Carl Challis, Kilgore; Clifford Mayo, Palestine; Glen Frost, Jena; Ernest Tarkenton, Wichita Falls; Engel Schmidt, Leeville; and Bob Hull, Hennessey.

### Name change is announced

... by Northern Mud Co., Inc., Rocky Mountain distributor of Magnet Cove Barium Corp's. drilling-mud products. The new name is Magcobar Mud Co., Inc. With the name change, the company's line will be expanded to include foam and air. Magcobar Mud Co. has developed a new line of compressors for use in air mud foam drilling in conjunction with Clark Bros. Co.

### Frank Swinehart is promoted

... to operations supervisor at Woodward, Okla. by Western Co. A company employe in southwestern Kansas since 1956, he most recently was a sales engineer at Lib-

Engineered to meet the increasingly exacting demands of modern industry throughout the world, Cameron Ball Valves are your key to operating security with maximum economy. Developed by Cameron's continuing research and manufactured from steel and forgings produced by Cameron, these valves are unexcelled for general industrial, pipeline, and oilfield use. Cameron Ball Valves are available in ASA and API pressure ratings with any type end preparation desired, sizes 2″ to 36″. Amazingly compact and easy to operate, they are readily adaptable to automated or remote operation. Cameron Ball Valves feature the exclusive rotating seat principle which makes practical for the first time the "sealed for life" construction. Non-lubricated, bonnetless and glandless, they are maintenance free. Cameron Ball Valves assure you

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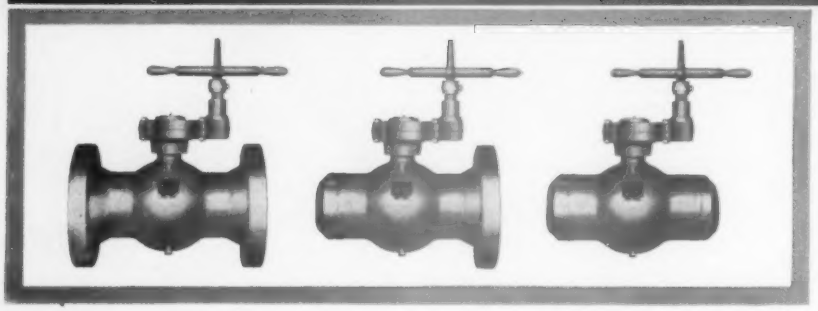

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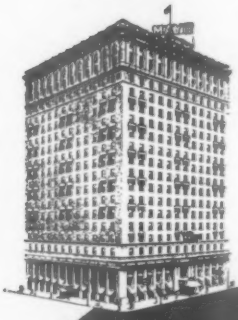

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eral. Tom McKinzie, succeeding him at Liberal, moves from his post as division chemist in the Oklahoma City service laboratory. Delbert Shelburne replaces McKinzie in Oklahoma City.

### Oil Well Supply Div. appoints

. . . Vernon L. Allmand as field representative at Shreveport, and Howard R. Dierking as district representative at McCook, Neb. Allmand was employed by the division in 1950 at Abilene, Tex. and was transferred to Shreveport last September. Dierking, employed by Oil Well Supply in 1953 at McPherson, Kans., has been a sales representative at Hill City, Kans. since January 1960.

### Holden G. Anderson is manager

. . . of oil-well-cement sales of Universal Atlas Cement Division, U. S. Steel Corp., according to James M. Adams, the division's district sales manager at Waco, Tex. Anderson takes to his newly created position more than 16 years of experience devoted to the division's oil-well-cement sales and customer service in Texas, Oklahoma, New Mexico, Mississippi, and Louisiana. He joined Universal Atlas in 1944 at Waco as oil-field sales representative.

H. G. Anderson

### Jetwell, Inc. makes changes

. . . announces William L. Carwile, president of the Tulsa wire-line-service company. Appointments involve: Jack Pouland, district manager at Wichita, now vice president in charge of sales; Joe Batt, named chief engineer in charge of operations with headquarters at Shawnee, Okla.; and Kenneth Harlow, assistant district manager at Great Bend, Kans., named district manager there.

### Robert B. Moore assumes post

. . . as manager of process-industries sales and engineering for General Electric Co. Moore will be responsible for the integration of sales and engineering work for products and systems requiring special or unusual effort in this market area.

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SINGLE OR MULTIPLE COMPLETION

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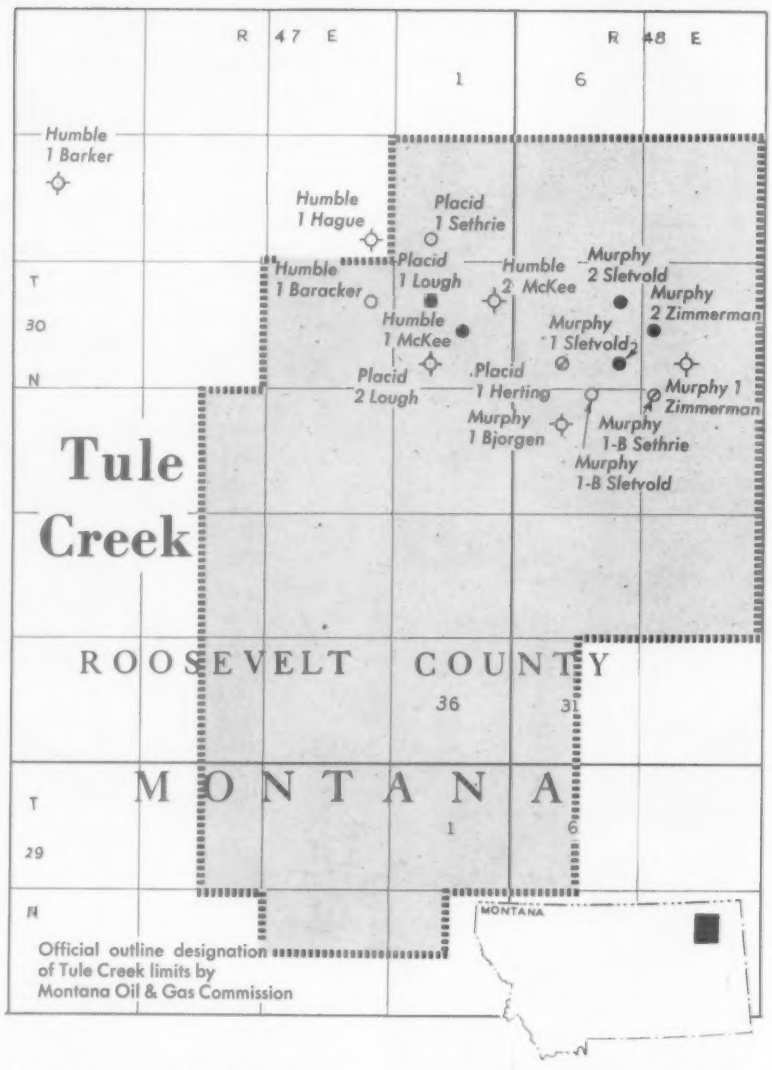
# Tule Creek, Roosevelt County, Montana

DATA ON ACTIVE FIELDS




1. Approved field name: Tule Creek. Location: Western Roosevelt County 23 miles west of Poplar in the Williston basin.

2. Discovery well: The Murphy Corp. 1 Sletvold, C SE SE 18-30n-48w. IPF 476 BOPD through 14/64-in. choke at perfs. 7,660-76 ft. and 7,686-92 ft. in Devonian-Nisku formation. Completed October 31, 1960.

3. Trend of development: Generally east-west.

4. Number of producing wells: five.

5. Spacing pattern: 160 acres.

6. Proved acreage: Currently 800, but more is probable.

7. Principal operators in area: The Murphy Corp., Placid Oil Co., Phillips Petroleum Co., Humble Oil & Refining Co., McAlester Fuel Co., Sinclair Oil & Gas Co., Davis Oil Co.

8. Present allowable: None.

### Drilling Operations

9. Number of active drilling rigs: three drilling, three locations.

10. Casing program: Surface is 8⅝-in. set at 625 ft. with 225 sacks of cement. Oil string is 5½-in. set at 7,750 ft. with 350 sacks of cement.

11. Average drilling time per well: 28-30 days.

12. Types of drilling fluid: Salt-base mud; average cost is $4,000.

13. Completion methods: Perforate casing with four shots per foot. Formation is treated with 500-gal. mud acid.

14. Types and sizes of bits: 7⅞-in. rock bits.

15. Special drilling problems: None reported.

### Geology

16. Producing formation: Devonian-Nisku at 7,660-92 ft. in discovery well.

17. Reservoir characteristics: Water (?) drive not definitely determined.

18. Geologic markers: Piper ls. 5,082 ft.; Madison 5,908 ft.; Bakken 7,569 ft., Nisku 7,662 ft.; Ireton 7,744 ft.; and TD 7,754 ft.

19. Type trap: Anticlinal feature with some faulting present.

20. Core analysis data not available. Electric-log analysis indicates porosity of 15%, connate water 25%, shrinkage factor 1.41, and net average ft. of pay is 40 ft.

21. Estimated recovery: 175 bbl. per acre-ft.

22. Pressure: Nisku 270 psi., tubing.

23. Tests and logging procedures: Core and drill-stem test the Nisku. Sonic and Microlateral logs are run from 5,000 ft. to TD.

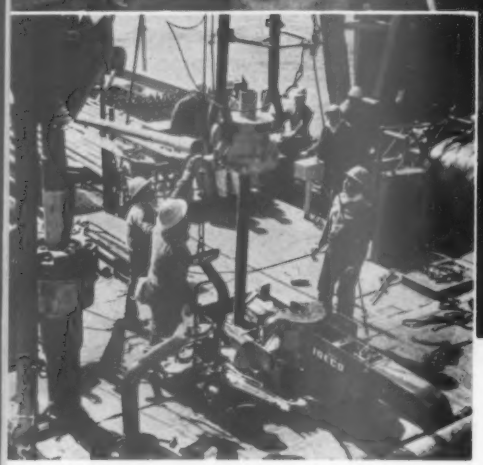
24. Pipeline outlets: Trucked to Poplar Station of Butte Pipe Line Co.

25. Exploration methods before discovery: Seismic and subsurface geology.

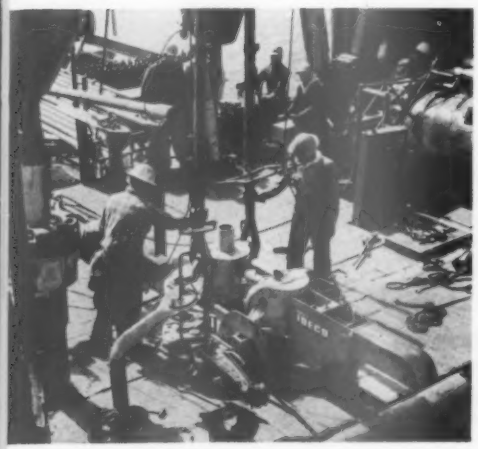
26. Average costs: Dry hole, $75,000, flowing well, $115,000, pumping well, $135,000. Average TD 7,760 ft. Footage rate, $5.35. Day rate, $1,145 with pipe and $1,060 without pipe. Average lease price was $40.48 per acre at recent Indian Lands sale.

27. Crude analysis: 40.8° API gravity, 0.1% sulfur, 35.7 sec. viscosity at 100° F. SU, pourpoint below −85° F., 0.2% b.s. and w., salt 275,720 p.p.m.

**MOHOLE REPORT:**



Above: A stand is being lowered into the hole. Below: Links are shifted automatically as two elevators rest on base.



# 12,000 ft. Drill String Handled By IDECO's Dual Elevator System

"An incredible feat."

This was the oil industry's concensus on the successful completion of Phase I of Project Mohole. CUSS I had drilled 600 feet into the ocean's floor under 12,000 feet of water off lower California.

To the scientists and oilmen aboard CUSS I a major question was this:

"Would the 12,000 feet of drill pipe and the handling equipment supporting it withstand the bending and twisting moments to which the pipe and equipment would be subjected while drilling in open waters?"

The answer is history:

Ideco's Duo-Matic Dual Elevator System was specified for handling the high-alloy, vanadium type drill string at depths over 9,000 feet because the chances of losing the pipe were great.

The possibility of bending, scoring, notching or bottle-necking the drill pipe thus was reduced to the bare minimum because the Duo-Matic System supports the drill string at its strongest point, the tool joint. Only two special elevators were used for all pipe handling operations... no slips were needed. Elevator links were automatically shifted between the two elevators to permit faster and safer handling of maximum pipe loads.

Ideco's Duo-Matic Dual Elevator System contributed to the success of the Mohole Project. It can also save your drill pipe from damage in the slip area in deep work. Ask your Ideco representative for full details.

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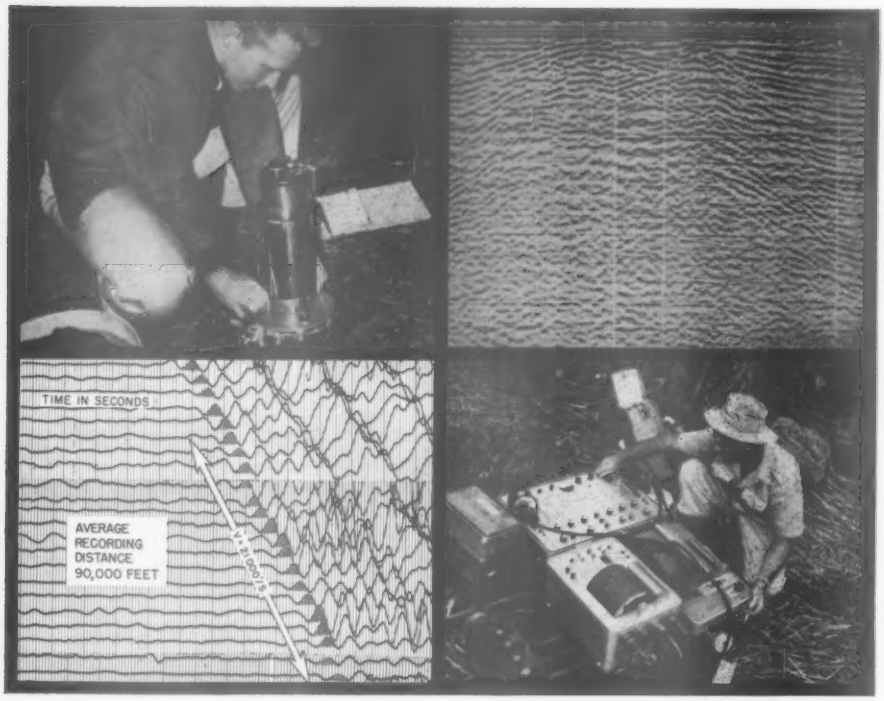


**this 12-page brochure briefly describes GSI's facilities for:**

- *Refraction Surveys*
- *Gravity-Magnetics*
- *Data Processing*
- *Offshore Surveys*
  - Single Ship
  - Seismic Underwater Explorer
  - Underwater Gravity
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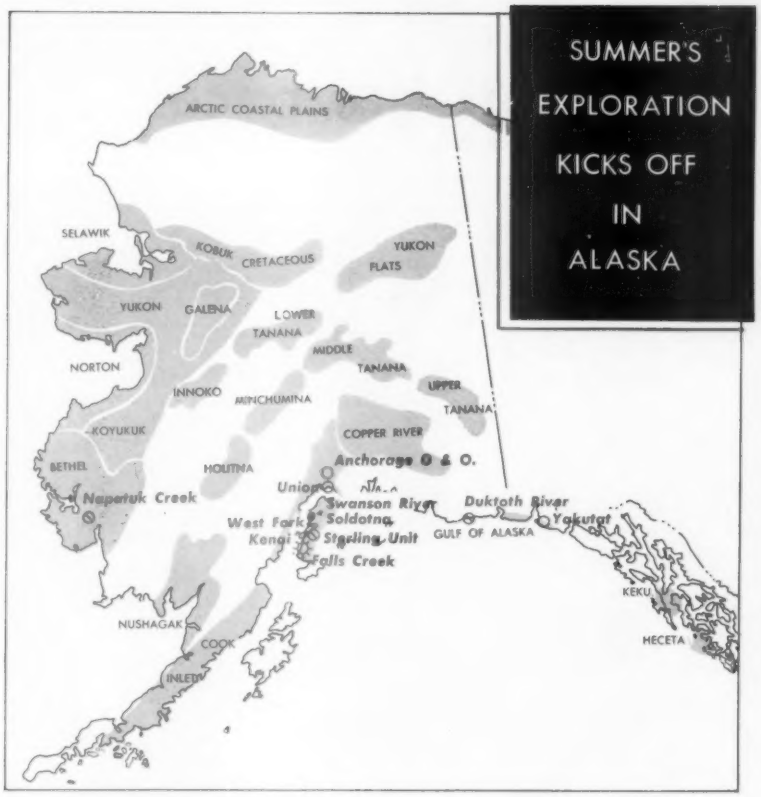



**THE SOUTHERN SHORES** of Alaska will buzz with oil activity in the months ahead. Drilling will span the entire state. Meanwhile, surface and seismic parties will swarm across the northern stretches, looking at the many unexplored basins there.

# Rigs will be busy in Alaska this summer

BY FRANK J. GARDNER

RIGS WILL BE BUSY in Alaska this summer. Four important wildcats are already on the way down, and several more are in the planning stage. Meanwhile, field development at Swanson River - Soldotna moves ahead swiftly. The active front skirts the entire Alaskan underbelly from west to east.

**Wildcats and field wells . . .** Way out west, Pan American Petroleum Corp. is nearing 10,000-ft. target depth at the 1 Napatuk Creek, first test of the Bethel basin. A hit here would open wide new horizons for Alaskan oil, for Bethel is an enormous trough, and about 6 million acres are under lease there.

Busiest spot in the state is the Kenai Peninsula, where three and possibly four fields have been found. Swanson River-Soldotna now has 28 producers (27 oil, 1 gas), 6 drilling wells, and 2 new locations; 45 producers are expected for the field by year's end. Kenai and West Fork gas fields are on the idle list at the moment, since gas is an unwanted child in Alaska right now.

A new gas field apparently has been tapped by Standard Oil Co. of California and Richfield Oil Corp. at the 1 Falls Creek, a directionally drilled wildcat on the eastern shore of Cook Inlet; the hole was bottomed at 13,789 ft. under the inlet waters and plugged back to 8,594 ft. where commercial gas flows were tested.

A new wildcat on the peninsula is Union Oil Co. of California and Ohio Oil Co. 23-15 Sterling unit, about midway between Kenai and West Fork gas fields. It could tell an interesting story of subsurface conditions in the intervening area. At last report, it was near the 2,500-ft. mark.

North of Anchorage, and across Knik Arm from it, two wildcats are in the "maybe" corner. Union is said to be planning a test of the Knik Arm unit; the company sank two strat tests here last year. A few miles to the north, Anchorage Gas & Oil Development, Inc., is expected to drill two tests in the vicinity of the four Rosetta wells drilled by the company in earlier years; Hackathorn Drilling Co. will operate these two.

Far to the east, on the Gulf of Alaska, Richfield is below 3,000 ft. at its 1 Duktoth River, a wildcat just east of the Kaliakh River holes it drilled in 1960. The 1 Kalaikh was temporarily abandoned at 14,699 ft., while the 2 Kaliakh was plugged at 9,575 ft.

Finally, in the Alaskan Panhandle, Colorado Oil & Gas Co. has permit approved for "Core Hole No. 1" in the Yakutat area, northwest of its 1960 deep failure (8,634 ft.) at 1 Dangerous River. Other companies interested in the Yakutat venture are Sinclair Oil & Gas Co., Continental Oil Co., and Frankfort Oil Co.

**Widen the picture . . .** All this activity, plus reserves already found, plus the wide range of companies involved, plus two big land sales coming up, adds up to just one thing. Rigs will be busy in Alaska this summer.

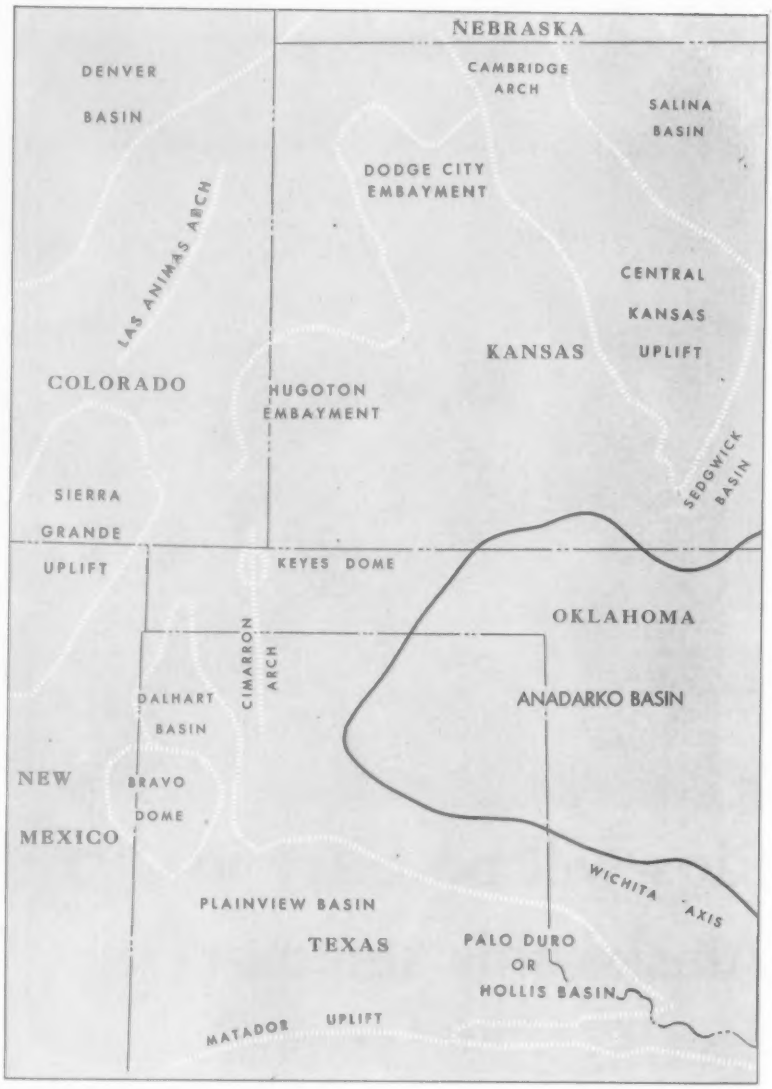
# Panhandle gas hunt sets hot pace

**In this two-part article, the author tells why Northwest Oklahoma is a wildcatter's paradise for gas. Part 2 follows next week.**

SUCCESS RATIO and drilling capacity in Oklahoma during the past few years has been stimulated by gas discoveries in the northwestern part of the state. New zone discoveries and field extensions have become almost commonplace, and a well must now have an exceptionally large potential before it makes headlines. Many general exploration articles have been written since the drilling boom started, but development progress has been so rapid that articles quickly become obsolete.

Northwest Oklahoma has been a "wildcatter's dream," with a discovery ratio exceeding 50%. This success ratio has offset errors in geologic thinking when the original objective tested dry, and the well was plugged back and completed in an unexpected zone. Multiple pay zones are found throughout the area, and new producing zones are easily overlooked.

The region lies on the flank of the Anadarko basin with moderate producing depths ranging from 3,000 to 8,000 ft. Production is pushing steadily toward the deeper portion of the basin, and results on the flank will be the key to development of the entire deep basin. Most of the deep basin has the same productive zones that occur on the flanks, but at an increased depth. Operators consider this area to be a proving ground for future deep drilling in the Texas Panhandle and all of northwestern Oklahoma. The single most critical factor is economics. Will deeper drilling prove to be profitable?




**TECTONIC ELEMENTS** of the Panhandle region, based on interpretations of Wellman, Merriam, Totten, and others. The Panhandle area lies on the western shelf of the deep Anadarko basin. Fig. 1.

The purpose here is to present a background of present development and a prediction of future gas production in Cimarron, Texas, Beaver, and Harper counties. The area will be referred to as the Panhandle even though it is slightly more extensive than the true Panhandle. The development history will be dealt with briefly, along with geology and reserves.

All data and maps show only gas statistics and development. Information on oil production has been ex-

## The author . . .

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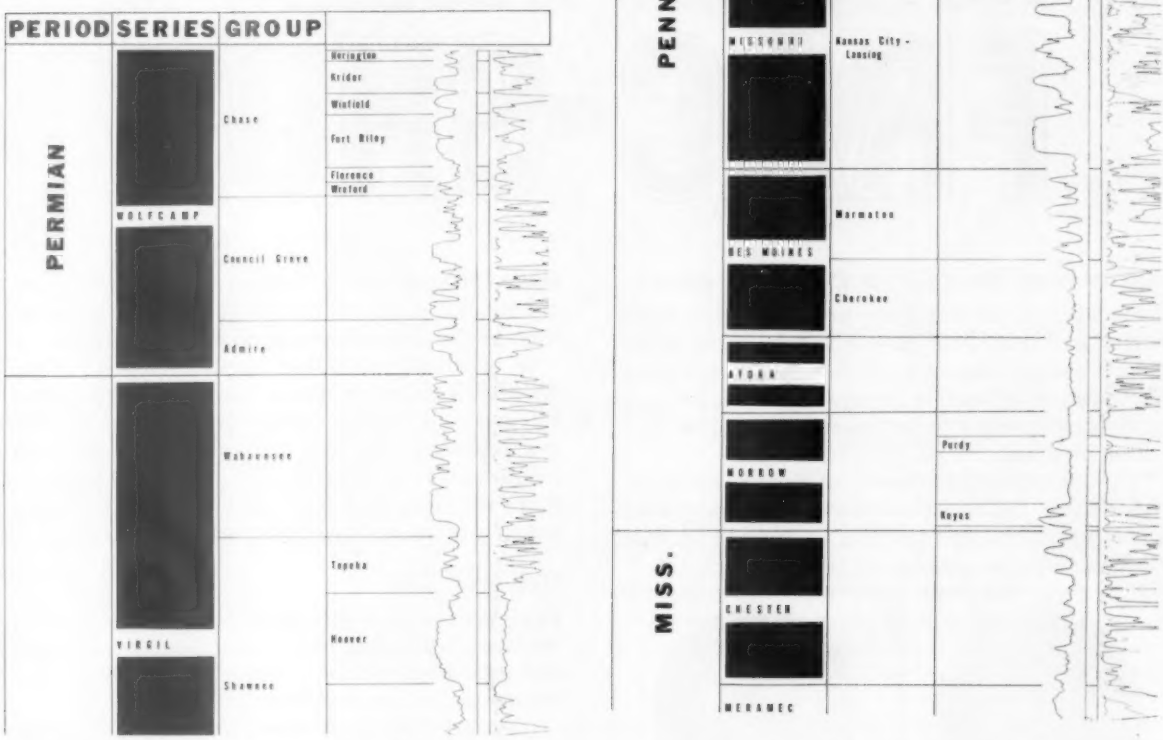


**THIS TYPE SECTION** of the Panhandle area shows all the important producing horizons discussed in the text. The type electric log (after the Liberal Geological Society's type log), shows the character of producing zones, but formation character varies so widely that no one log is truly typical. Fig. 2.

cluded, but should not be overlooked, since the area has many oil fields. However, the oil fields are developing more slowly due to smaller spacing, and gas production has been the principal objective.

Both federal and state politics have interfered with development of the area, and its effect cannot be ignored. Gas has now become a political commodity along with Castro's sugar and overseas oil.

The Federal Power Commission rules the price and transmission of gas with mysterious and tight controls. Virtually all the gas from the Panhandle is exported to another state, thus falling under FPC control. The price allowed, even though it is a record high for Oklahoma at 17 cents per M.c.f., is still low enough to represent unfair competition with oil. Delays in FPC rulings have cost operators a fortune in interest on investment while waiting for a pipeline.

On the state level, it is to the credit of the Oklahoma Corporation Commission that this area has been spaced one well to each 640 acres for gas production. However, many areas that were spaced far in advance of development need spacing revisions so that the rules will conform to the geology established by subsequent drilling. Inequitable withdrawals by gas-purchasing companies have caused the commission to allocate five of the largest fields in the Panhandle. The most recent field allocation includes a portion of Mocane-Laverne field and becomes effective September 1, 1961. This allocation is especially significant, since it properly allows some credit for reserves. Formerly, most allocations were made on a potential and acreage basis only, causing operators to compete needlessly with expensive fracturing techniques. Under the new allocation, the formula will include acreage, potential, and pressure factors. This is a much more reasonable approach to allocation.

### Geology

Shown in Fig. 1 are the major tectonic features of the Central Mid-Continent area. Note that most of the Panhandle lies on the Anadarko basin shelf, usually referred to as the Hugoton embayment. The Anadarko basin and its provinces have

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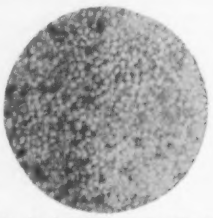
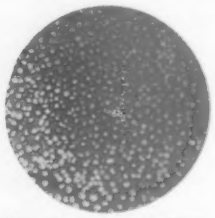


Standard 14/18 mesh ottawa-type sand at 10,000 ft. Note how grains crush and pack together, blocking flow.



12/16 aluminum Frac-Shot at 10,000 ft. Sparse distribution permits free flow.

Photos courtesy Pan American Petroleum Corporation and The Atlantic Refining Company.

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been limited in all directions and influenced in the past by the following pronounced structures: Nemaha ridge to the east, Wichita-Amarillo mountains to the south, Sierra Grande uplift to the west, Las Animas arch to the northwest, and the Cambridge arch-Central Kansas uplift to the north.

The only major structure crossing the Panhandle area is the Cimarron arch. It is a broad north-south-trending uplift which begins in southern Sherman County, Texas, crosses the Oklahoma Panhandle in eastern Cimarron County, and plunges into the Southeast Colorado portion of the Hugoton embayment near the Colorado-Oklahoma line. The principal feature of this area is the Keyes dome, with structure in excess of 200 ft.

Geologically, the Panhandle is an area of transition. Sediments undergo complex changes from shale to sandstone to limestone in a basin-to-shelf direction. This condition is principally responsible for the many stratigraphic traps that occur. There is a complex maze of producing zones, so the information was condensed by geologic series to avoid excessive detail.

The general geologic column and type log for the area is shown on Fig. 2. While the full column is not shown, all of the important producing horizons found so far are included. Most of the names are probably familiar, since they are in common usage. However, the geologic rank is frequently misunderstood. The type electric log shows the character of producing zones, but variations of character are widespread throughout the Panhandle, and no one log is typical. There are only three geologic periods represented on this column—the Permian, Pennsylvanian, and Mississippian. These three have a total of six series which are considered to be of major productive importance. They are (youngest to oldest) Wolfcamp, Virgil, Missouri, Des Moines, Morrow, and Chester. Within these series are numerous producing formations and members, some of which are named. There are only three horizons producing outside this geologic column. They are:

| | | | |
|---|---|---|---|
| Red Cave | McBride 1 Godwin | 29-1n-9ecm | Shut in |
| Hunton | Statex Petr. 1 Bennett | 29-27n-21w | Producing |
| Viola | An-Son 1 Bender | 7-28n-22w | Shut in |
| Viola | Sinclair 2 Holcomb | 7-28n-22w | Shut in |

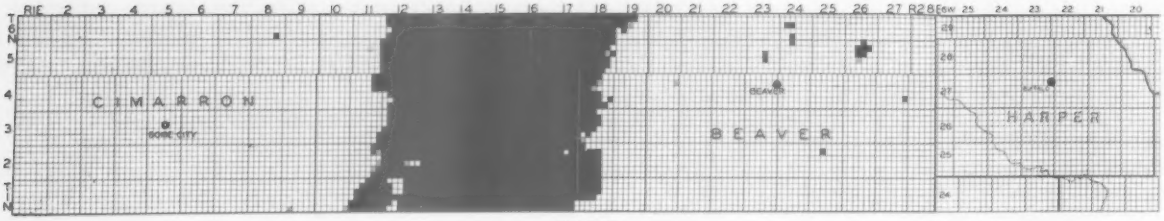
**TABLE 1—PANHANDLE AREA PRODUCING AND SHUT-IN WELL TOTALS**
By zone, by county, April 1, 1961

| | Cimarron | Texas | Beaver | Harper | Total |
|---|---|---|---|---|---|
| WOLFCAMP | | | | | |
| Producing | 1 | 1,384 | 14 | 0 | 1,399 |
| Shut in | 1 | 10 | 2 | 0 | 13 |
| Total | 2 | 1,394 | 16 | 0 | 1,412 |
| VIRGIL | | | | | |
| Producing | 2 | 10 | 62 | 87 | 161 |
| Shut in | 4 | 16 | 4 | 2 | 26 |
| Total | 6 | 26 | 66 | 89 | 187 |
| MISSOURI | | | | | |
| Producing | 1 | 0 | 109 | 45 | 155 |
| Shut in | 0 | 0 | 22 | 4 | 26 |
| Total | 1 | 0 | 131 | 49 | 181 |
| DES MOINES-ATOKA | | | | | |
| Producing | 3 | 10 | 0 | 2 | 15 |
| Shut in | 9 | 4 | 2 | 0 | 15 |
| Total | 12 | 14 | 2 | 2 | 30 |
| Producing | 139 | 182 | 273 | 96 | 690 |
| Shut in | 9 | 26 | 101 | 36 | 172 |
| Total | 148 | 208 | 374 | 132 | 862 |
| CHESTER | | | | | |
| Producing | 0 | 8 | 119 | 86 | 213 |
| Shut in | 0 | 3 | 41 | 10 | 54 |
| Total | 0 | 11 | 160 | 96 | 267 |
| Total by county | 169 | 1,653 | 749 | 368 | |
| Total wells by zone | | | | | 2,939 |

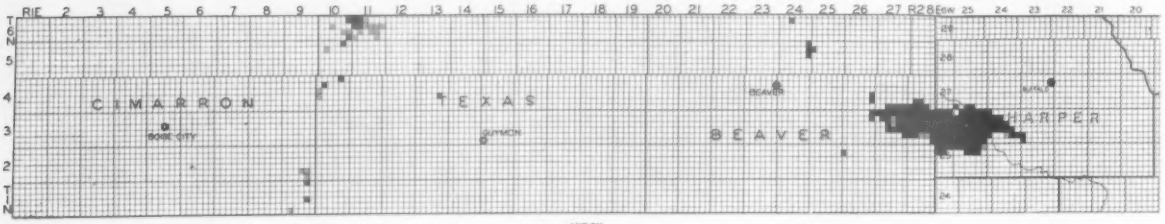
The composite production map shows the total number of **producing gas wells** completed on April 1, 1961, (Fig. 4). All zones are included on this index map. Each section that contained a producing gas well was blackened, even though a few tracts are not unitized under this spacing. There are now about 2,600 producing gas wells in the 4 counties. The total area controlled by this production is more striking than the number of wells. By comparison, the area under production is larger than the State of Delaware. This is the way production is usually pictured in the area, but it does not illustrate the trends of the numerous producing zones. The producing zones are stacked, and many wells have been dually completed. Therefore, this map shows nothing more than gross acreage held by production, or conversely, the acreage available for future drilling.

It is impossible to foresee the future without looking at the past. For this reason, a complete look at current production of the area is necessary. Rather than refer to production from each of the many individual formations, they will be condensed into series and will be covered from shallowest to deepest. Some of the component formations of each series will be discussed.

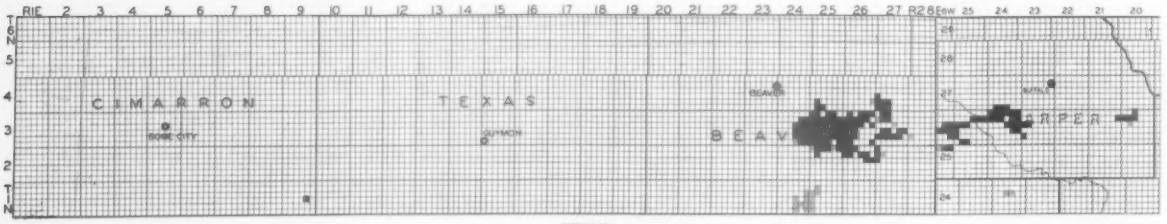
Fig. 3 shows the production by geologic series, and is shaded for easier recognition of geologic rank. All shading shown on each of these maps indicates that there is a well in that particular section completed from that series before April 1, 1961. No well was plotted as completed until official completion information was received. Each well is assumed to control a full 640 acre section. Black indicates that the well was producing prior to March 1, 1961. All lightly-shaded sections are completed wells which are still shut in, and can be considered to show the more recent, successful wildcat completions or important field extensions. However, it should be understood that there are many wells in the Panhandle area with more than one gas purchaser. Thus, the fact that a section is producing does not mean that all of the gas from that particular tract is committed, and it may in time have an additional purchaser.



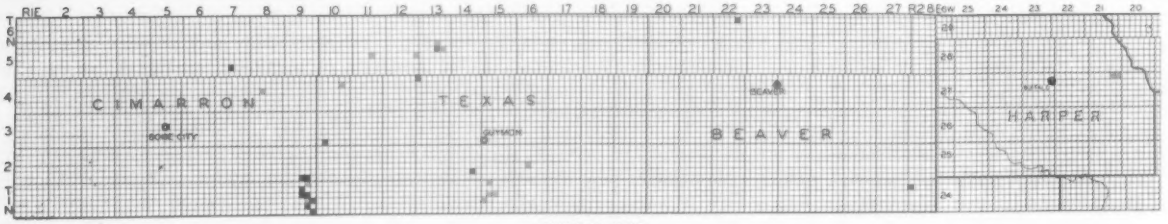

WOLFCAMP



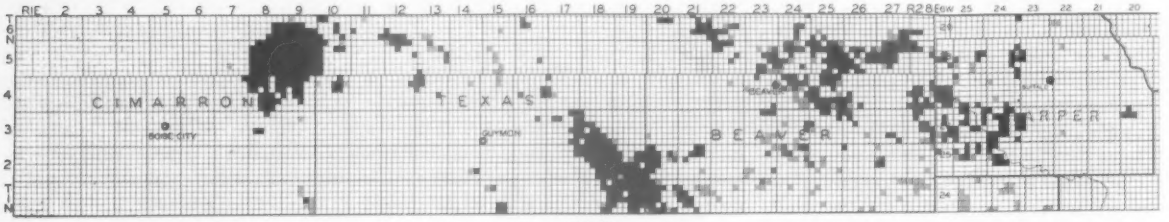

VIRGIL



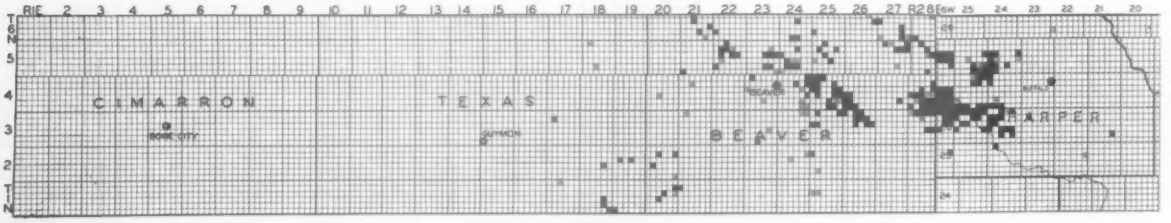

MISSOURI




DES MOINES–ATOKA

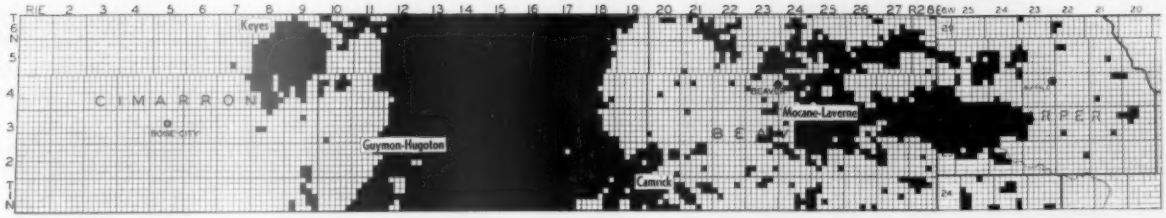



MORROW




CHESTER

**THIS SIX-MAP SERIES** shows what is producing where. On 640-acre spacing, these gas wells are divided into two classes; those wells producing before March (black), and those of more recent completion (light shading). The black sections are not necessarily all presently committed. In time to come, more than one purchaser may buy gas in a certain locale. Fig. 3




**THIS COMPOSITE PRODUCTION MAP** represents about 2,600 producing wells in four counties of Northwest Oklahoma. The total producing area is larger than the State of Delaware. More impressive than the area itself is the realization that a multiplicity of reservoirs underlies the gross acreage held by production. Fig. 4.

**Wolfcamp series.** The wide band across Texas County (Fig. 4) is the vast Guymon-Hugoton field. This production is from the Chase group of the Wolfcamp, the field contains 1,394 wells in Oklahoma, and its extensions north and south into Kansas and Texas have many more. This field has been completely developed, and the only shut-in wells are small wells along the flank and inside the field. Widely scattered, isolated production is also found throughout the Panhandle area, but these are apparently small reservoirs.

The more important recent zone discovery from this series is the Council Grove in Beaver County. There are five separate areas in Beaver County producing from the Council Grove. Possibly many more older wells may be recompleted from the Council Grove.

**Virgil series.** Topeka and Hoover zones are the most important producing horizons of Virgil age. The Topeka production is found in southeastern Cimarron and northwestern Texas counties. The fact that this zone is still being developed is illustrated by the large number of shut-in wells and the undeveloped tracts inside the fields.

Moving to Beaver and Harper counties, Mocane-Laverne field produces from the Hoover zone. This sand body is the largest producing unit of the series and the areal extent of the field has been well defined. On the northwest and southwest corners of this field, some production is secured from the Lovell. Lovell production can be expected to expand from these tracts. In north-central Beaver County, the Toronto produces in five wells.

**Missouri series.** Production from the Missouri series is confined to the Lansing (one well in southeastern Cimarron County) and to the Tonkawa sandstones of Beaver and Harper counties. Additional extensions and some inside development can be expected from the Tonkawa.

**Des Moines-Atoka series.** These are actually two separate series that have been combined to condense the information. The Des Moines series contains the important producing horizons which are Cherokee and Oswego. Both zones produce in southeast Griggs field of southeastern Cimarron County. These same zones also produce across the Panhandle area from scattered tracts. The Cherokee is coming into prominence as a better oil than gas reservoir. However, new discoveries are expected from both the Cherokee and Oswego. One-half of all wells completed from the Cherokee and Oswego are still shut ins.

**Morrow series.** The Morrow produces throughout the Panhandle area, and is considered the most important objective. Other series are more limited in areal extent of production. In number of completed wells, the Morrow series ranks second only to the Wolfcamp. On April 1, 1961, there were 862 wells completed from sandstones of this series in the Panhandle area. In time, the Morrow is expected to surpass the Wolfcamp in total number of completions.

The Morrow should not be considered the best economically or the easiest to find, however. Many wells have been completed from this series which will be a disappointment to the operators, yielding only marginal returns. This will be dealt with later under the subject of reservoirs. Finding Morrow production looks easy to the uninitiated. The widespread production from it gives the illusion that it can be easily found. But there are a number of dry holes and small producers within established fields.

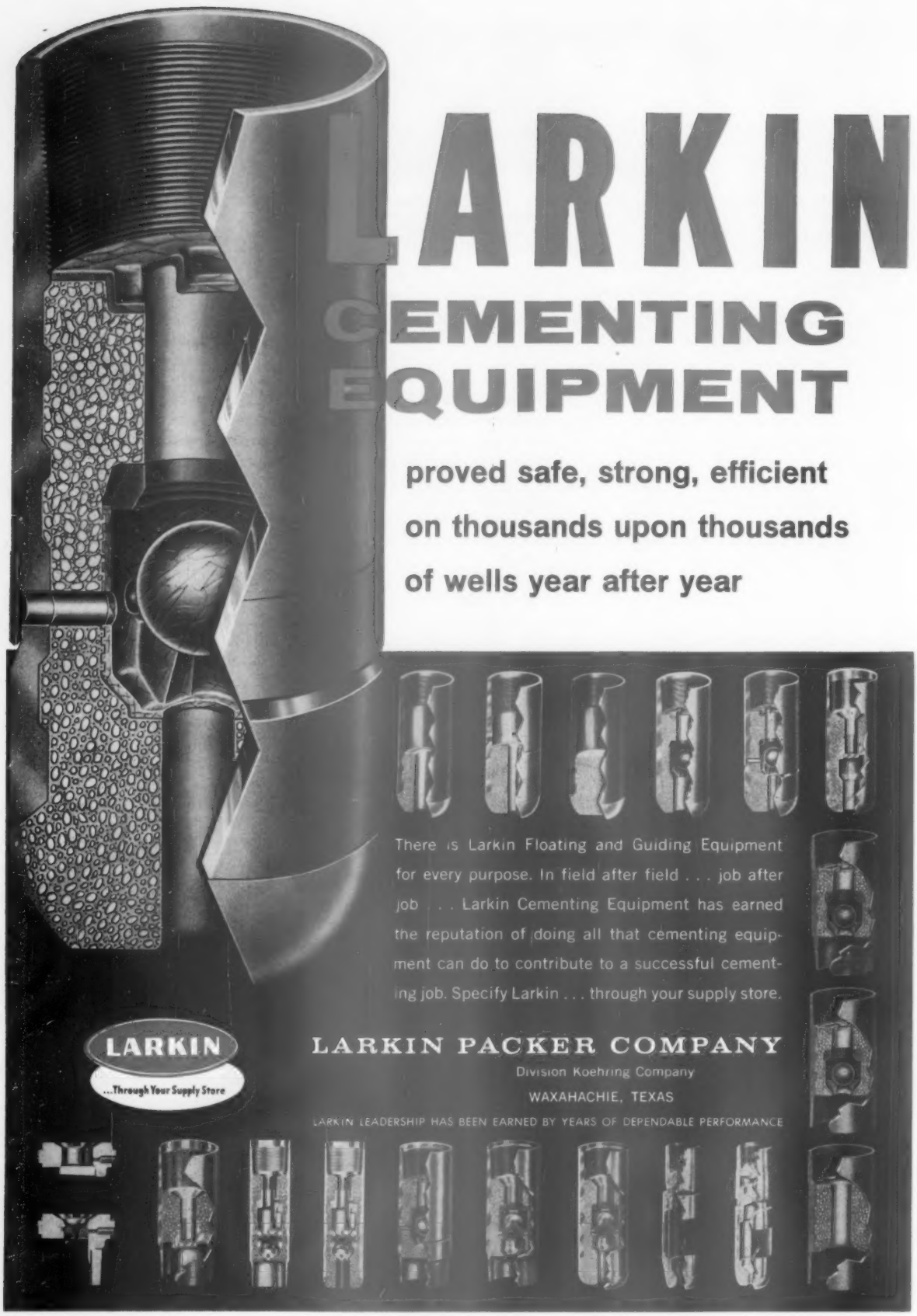
There are many individual sandstones within the Morrow series, and correlations across areas where the sandstones are locally absent are difficult. This has given rise to conflicting and confusing names applied to sandstone units within the Morrow. The two most prominent zones are the Purdy and Keyes, occurring in the upper and lower Morrow respectively. These two zones are accepted in literature because they are more extensive than other units, but it should be understood that other sandstone units produce within the Morrow. Classification and naming of Morrow sandstones by geologists are urgently needed.

Two fields with blanket production from the Morrow are Keyes and Camrick. Keyes field, in northeastern Cimarron County, produces from the Keyes zone where it extends over the structural dome mentioned earlier. Camrick field lies in southeastern Texas County extending into Beaver County. Trending in a southeast-northwest direction, it is part of a fairway that will probably extend diagonally across Texas County in time.

There are many scattered Morrow discoveries in Beaver and Harper counties; most of these are shut-in wells. These number too many to discuss individually.

Mocane - Laverne is the largest field and it produces from several different sandstones within the Morrow.

**Chester series.** Production from the Chester is confined to eastern Texas, Beaver, and Harper counties. No well in this area is considered properly evaluated until all the section has been tested through and including the upper portion of the Chester series. The limestones of the Chester series have not been evalu-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ated properly in some of the earlier field wells not penetrating the section. Generally, the Chester produces in a northwest-southeast trend and several of these trends can be seen where development is completed. The beginnings of other trends are suggested by recent discovery wells.

### New pay for Canada's Willesden-Green field

In Alberta, Canadian Homestead Oils, Ltd., has successfully completed a discovery well in a new productive horizon, the Belly River formation, in Willesden - Green oil field.

Homestead has a 7½% gross overriding royalty interest in this new discovery, Willesden Green 6-14-42-6, located on its 320-acre tract. The well has established a flow rate through a 20/64-in. choke of 336 bbl. a day from 24 ft. of net pay sand in the Belly River formation at 5,010 ft.

Nearest production is ⅞ mile from the Cardium sand, and nearest production from the Belly River horizon is 1¾ miles. The new well is also ½ miles south of Willesden Green 14-14, a test well which the same interests are currently completing in the Cardium sand.

## More drilling planned by Alaskan operators

TWO companies active in the past in Alaska have revealed plans to renew their exploration work in the state.

Anchorage Gas & Oil Development Co. plans to drill two exploratory wells in the Susitna Flats area about 20 miles north of Anchorage. The other new drilling plans call for a series of core holes in the Yakatat area by Colorado Oil & Gas Corp.

Several wells have been drilled in the Susitna Flats. Anchorage Gas & Oil drilled four wells in this area. The company took one, the 3 Rosetta, to a total depth of 6,109 ft. The company reports it has had gas shows in three of the wells, but none has been completed as a commercial well.

Union Oil Co. and Ohio Oil Co. did the most recent drilling in this


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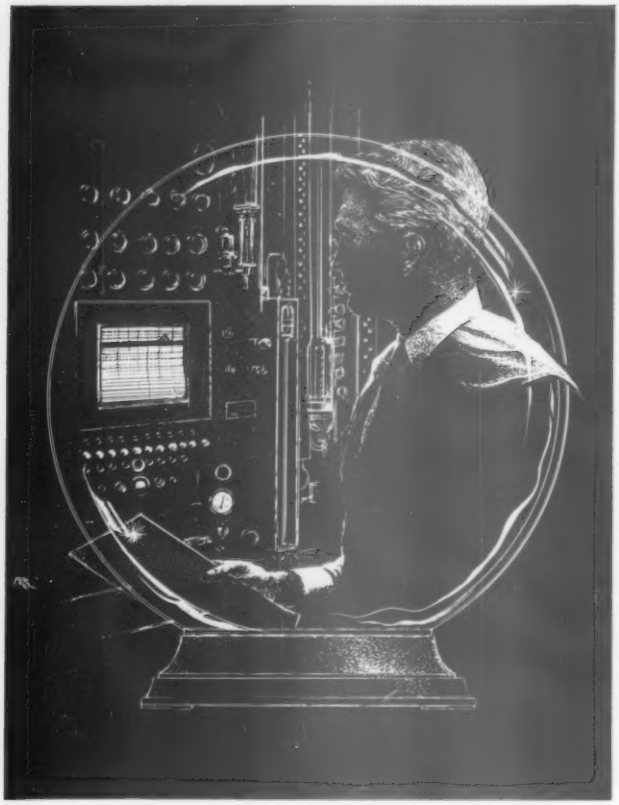

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area. The two drilled two dry holes about 10 miles south of the Anchorage Gas & Oil acreage last year (OGJ, Oct. 10, 1960, p. 114).

Colorado Oil & Gas plans three or four core holes on the Yakutat acreage. These holes will go to between 3,000 and 5,000 ft. deep in an effort to further determine the geology of the area. Colorado is the operator for a five-company group which has drilled four dry holes along the southern coast of Alaska.

## Sacramento Valley well drilled twice, completed

It took two drilling jobs to complete a small gas producer recently in West Grimes field of Colusa County, California.

Patrick A. Doheny, Los Angeles independent, took the 1 R. M. Farnsworth to 8,545 ft. on the first drilling job. A 5½-in. casing string was hung to 7,937 ft. But when the string was cemented the cement set up in the hole—and forced a redrill.

It took several days additional drilling to drill out the cement to 7,070 ft. to complete the well.

The well was perforated in several intervals between 6,980-7,033 ft. with total perforations hitting 31 ft. It was completed flowing 1,375 M.c.f.d. through a 12/64-in. choke, then shut in to await an outlet.

The 1 R. M. Farnsworth is the northeast offset of the field discovery well, 1 Sachreiter. It is the fifth completion for the field, which was discovered last year.

## Pool found in California

Richard S. Rheem, San Francisco independent, has discovered a new middle Stevens pool in Canfield Ranch field, Kern County, California.

Rheem's 11X-34 Norris-KCL A is productive in the upper zone of the middle Stevens, but dry in the lower zone. The well flowed 168 bbl. daily on a drill-stem test of three intervals at 9,018-42 ft., 9,056-62, and 9,072-85. The flow was 29°-gravity crude through a 14/64-in. choke with a casing pressure of 350 psi. After going on pump, the output dropped to 143 bbl. daily with a 7.2% cut of water, mud, and emulsion.

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The well went to a total depth of 10,860 ft., but failed to come up with commercial oil during tests from 10,123-10,290 ft.

The 11X-34 is about ¼ mile southeast of the limits of the oil area of Canfield Ranch and in an area of limited drilling.

## Ohio's oil picture

ACCORDING TO statistics compiled by the Ohio Division of Geological Survey, 79% of the tests completed for oil and gas in Ohio during the first 3 months of 1961 were productive.

Of the 207 holes drilled, 58 produced gas, 106 were oil wells and 43 were dry holes. A total of 537,275 ft. of hole was drilled. The average daily initial open flow of the gas wells was 1,725 M.c.f. and their average total depth was 2,940 ft. The average initial daily production of the oil wells was 36 bbl. of oil per day, with an average total depth of 2,494 ft.

Thirty-six exploratory holes (about 17% of the total holes drilled) accounted for 119,312 ft. of drilling, and resulted in 5 gas wells and 16 oil wells. Thus, about 60% of the exploratory tests drilled were productive. Three of the gas wells produced from the Clinton sand, one from the Berea, and one from the sub-Trenton (Trempealeau?). Of the 16 oil wells, 14 were Clinton producers, 1 was Berea, and 1 produced from the Medina sand.

The Clinton sand led all productive zones in completions with 107, of which 38 were gas wells, 59 were oil wells, and 10 were dry holes. The Berea sand was second in completions with 31, of which 3 produced gas, 24 produced oil, and 4 were dry.

The largest oil well completed during the first quarter of 1961 was the 1 D. E. Turner, in Richland Township, Fairfield County, which had an initial production of 400 bbl. of oil per day from the Clinton sand, total depth 2,546 ft. The largest gas well completed was the 1 V. Gorby Hours, in Swan Township, Vinton County, which tested an initial daily open flow of 10,190 M.c.f.d., from the Clinton sand, total depth 2,978.

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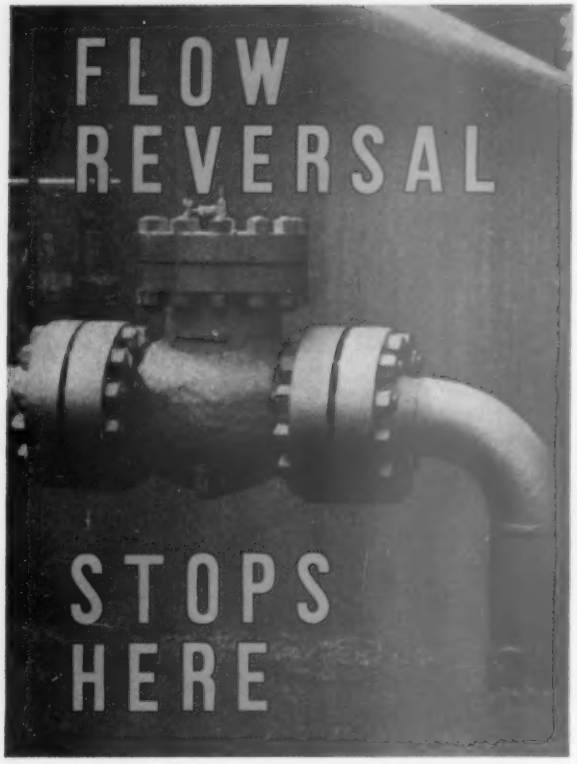


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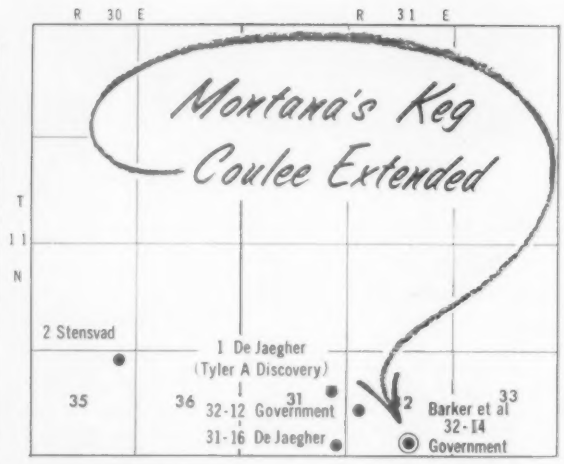


**MONTANA'S KEG COULEE FIELD,** Musselshell County, was extended by a prolific Tyler A sand producer.

## Big extension well reported in Montana's Keg Coulee

IN MONTANA Lawrence Barker, Jr. et al. swabbed and flowed 500 bbl. of oil in less than 4 hours at 32-14 Government in SE SW 32-11n-31e, Musselshell County.

Recovery is from Tyler A sand at 4,376 ft., a notch. This well is an east extension to Keg Coulee field. It is the southeast offset to the 32-12 Government in NW SW 32-11n-31e, which pumped 100 bbl. per day from lower Tyler perforations at 4,512-21 ft. West of this well, the 31-16 DeJaegher, SE SE 31-11n-31e, pumped 280 bbl. per day from Lower Tyler perforations at 4,579-91 ft. The 1 DeJaegher in C SE NE 31-11n-31e was the Tyler A sand discovery well, pumping 177 bbl. per day from perforations at 4,302-16 ft. Two miles west of here, Sumatra Oil 2 Stensvad, C NE NE 35-11n-30e, a lower Tyler discovery, flowed 277 bbl. daily from 4,594-4,604 ft.

## Mississippi discovery well taps Rodessa pay in Jones County

RODESSA oil production is reported at a Jones County wildcat, 2½ miles southeast of Sandersville field, Mississippi. The discovery well is E. L. Erickson 1 W. E. Weems et al., 22-9n-10w.

The well flowed 576 bbl. of 33.8°-gravity oil per day on ¼-in. choke from perforations at 11,221-24 and 11,227-35 ft. Plans call for making more perforations at 10,702-16 ft. for a dual completion. More than 90 ft. of net pay sand was logged in the Mooringsport and Rodessa. Best Mooringsport shows were at 10,177-91 ft. Quick followup drilling is expected. Location is already being cleared for the south offset. It will be Placid Oil Co. 1 George Smith in SE NE 22-7n-12w. Zach Brooks Drilling Co. will have contract for the 11,600-ft. test. Several other tests are in the mill but no details are available.

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## Oil activity increases in Illinois in April

A total of 126 new oil and gas tests were reported completed in the 5-week period of April. This is an average of 25 completions a week as compared with 15 a week in March. The new tests in April resulted in 58 oil wells and one gas well, a success ratio of 47%. In addition, two wells that had previously been completed as dry holes were worked over and recompleted as oil wells.

Good oil wells continue to be completed in sections 20 and 29, 4s-10e, about 3 miles west of Crossville, White County. Five oil wells were reported completed in this area in April, with initial potentials of from 110 to 785 bbl. of oil a day. Four of the wells are producing from O'Hara limestone and one from Cypress sandstone. In this same area 11 oil wells were completed in the first quarter of 1961 with initial production figures averaging 450 bbl. of oil a day.

In 12-5s-9e, just north of Carmi and about 4 miles southwest of the area described above, six oil wells were reported completed in April by the National Associated Petroleum Co. Five of the wells were completed in the Aux Vases, and one was a dual completion in the Aux Vases and O'Hara. Initial potentials ranged from 37 to 387 bbl. of oil a day and averaged 150 bbl. a day.

No new oil or gas pools, extensions to pools, or new producing strata in pools were discovered in Illinois in April. Estimated production for Illinois in April is 6,395,000 bbl.

## Albion-Scipio extension planned

First of five planned Trenton wildcat tests several miles northwest of the farthest north developed production on the 35-mile long Albion-Scipio trend is scheduled to start this month.

McClure Oil Co. and Perry Fulk will drill each of the five wildcats, 5,500 to 6,500 ft., in a program worked out with some 14 acreage holders in the blocks to be tested. First location was announced as NW SE SE 3-4n-8w, Barry County, about 30 miles northwest of Cal-Lee pool, Calhoun County.

Each of the five programed locations are based on extensive gravity surveys supported by the several companies involved.

## Gas discovery completed in Louisiana's Iberia

State gage is reported at Texas Gas Exploration Co. A-1 State Lease 3317, new gas discovery in Iberia Parish's South Lake Sand area.

The well, located in East Cote Blanche Bay, flowed 3,600 M.c.f.d. and 30 bbl. condensate per million from a 12-ft. sand topped at 14,850 ft.

**Plaquemines Parish.** Gulf Oil Corp. C-1 Mark Delesdernier, new Plaquemines Parish discovery, 1½ miles east of West Bay field, flowed 208 bbl. of oil per day on state test. Production is from perforations at 8,651-64 ft. Location is in 5-23s-31e.

## Louisiana's Union Parish has new condensate strike

A condensate discovery is reported in Union Parish, northern Louisiana. The discovery well is Southwest Gas Producing Co., Inc. 1 J. J. Hamilton unit, 30-19n-1e, 1¾ miles south of Downsville. The well flowed 4,149 M.c.f.d. and 168 bbl. condensate from Vaughn sand of the Cotton Valley Jurassic at 9,024-39 ft. Location is 4 miles northeast of Tremont field and 6 miles north of Calhoun field.

## New Abo area in New Mexico gets confirmation

Confirmation of a new Abo reef discovery is reported in eastern Eddy County, Southeast New Mexico, 4 miles east of Loco Hills in 24-17s-30e. The well is Nash, Windohr, & Brown 23-B Jaskson, east offset to the 22-B Jackson, field discovery.

The new well flowed 85 bbl. of 44°-gravity oil per day through 10/64-in. choke from perforations at 6,955-80 ft. Location is inside shallow Premier field production.

## Good producer extends Wayne County pool in Ohio

In Ohio, north of Shreve, Ohio Fuel Gas Co. moved about ½ mile from production in Clinton Township, Wayne County and finaled a good producer on 1 Max H. Kester, Section 14.

The Clinton sand at 3,118-48 ft. had a showing of oil and 145 M.c.f.d. natural. After fracture it flowed 98 bbl. of oil in 4 hours. The gas gaged 1,946 M.c.f.d. and rock 1,050 psi.

• Waverly Oil Works reported a ¼-mile stepout in Fallsburg pool, 1 C. H. Morris, Section 10, Fallsbury Township, Licking County, made 250 bbl. of oil in a 14-hour test after fracture. The Clinton sand was logged at 3,064-3,105 ft. and had a good showing of oil natural.

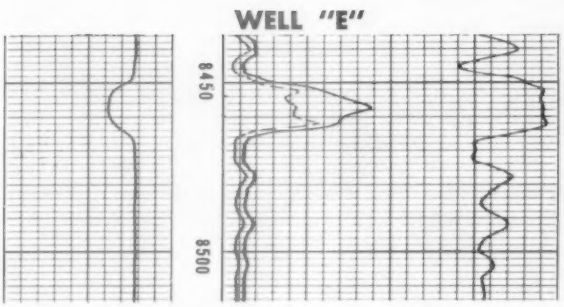
## Deep pay zone reported in Arkoma basin wildcat

Deep production is reported at Midwest Oil Corp. 1 Goldsborough in SE SW NE 31-7n-23e, Norris shallow field, LeFlore County, Southeast Oklahoma. The well flowed up to 1,004 M.c.f.d. on a 1-hour test. Top of the Cromwell was 11,790 ft. Drilling break was at 12,544-45 ft. Drilling continues below 12,786 ft.

## Western Canada completions—April 1961

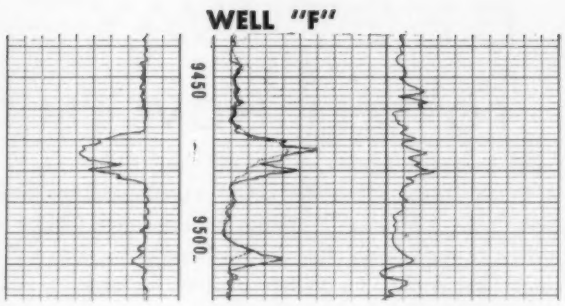
| | All wells | | | | | | | Wildcats | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | Oil | Gas | Dry | Service | Footage | Cum. wells 1961 | Total | Oil | Gas | Dry | Footage | Cum. wells 1961 |
| Western Canada | 130 | 72 | 24 | 33 | 1 | 890,406 | 714 | 24 | 4 | 6 | 14 | 168,513 | 226 |
| Alberta | 101 | 55 | 21 | 24 | 1 | 768,023 | 482 | 18 | 3 | 5 | 10 | 134,582 | 147 |
| Saskatchewan | 21 | 15 | 1 | 5 | 0 | 80,951 | 145 | 2 | 1 | 0 | 1 | 10,069 | 20 |
| Manitoba | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 1 |
| British Columbia | 7 | 2 | 2 | 3 | 0 | 39,124 | 68 | 3 | 0 | 1 | 2 | 21,554 | 48 |
| Northwest Territories | 1 | 0 | 0 | 1 | 0 | 2,308 | 10 | 1 | 0 | 0 | 1 | 2,308 | 10 |
| Ontario | 0 | 0 | 0 | 0 | 0 | 0 | 62 | 0 | 0 | 0 | 0 | 0 | 0 |

# WHICH WELL WAS THE PRODUCER?
# #3

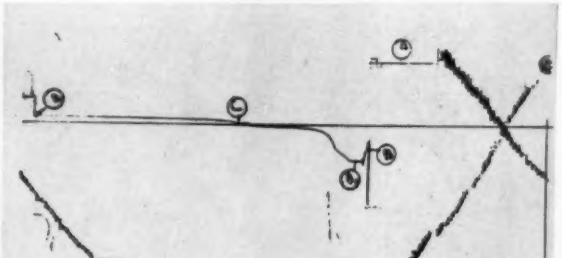



Well "E" was drilled to penetrate a known producing sand. The expected zone was found a interval 8454'-8460'. Electric logs gave good indications, and, when compared with logs from wells in which this zone was flowing commercially, curves were found to be almost identical. Analysis of cuttings showed 16% average porosity and 60.4% fluid saturation. Would you set casing on this well? Before reading further, study Well "F" log and compare with Well "E".

Prospects on this well were considered favorable enough that the operator was ready to set casing. To obtain conclusive information, Johnston Testers performed a drill stem test recovering 30' of muddy water and 558' salt water.




While drilling Well "F", yellow fluorescence was noticed in cuttings from the interval 9470'-9480'. Drilling continued to T.D. and electric logs were run. These indicated favorable conditions at the above-mentioned interval. Analysis of cuttings and sidewall cores showed 31.8% average porosity and 73.6% fluid saturation (18.5% oil, 55% water). Would you set casing on this well? Now study the drill stem test charts on Well "E" and Well "F" for additional data.



Additional logs were run for further study. As final step in evaluation, Johnston Testers performed a drill stem test. The 4000' water cushion reached surface in 18 minutes and the well flowed pipeline oil.

A decision based on logs and geological data alone could have been very costly. Well "F" was the producer. The operator on Well "E" stated that the D.S.T. saved him thousands of dollars in casing alone. Conditions may appear favorable, but the only sure way to determine if, and what a well will produce is with a drill stem test. You can save thousand of dollars, too! Call Johnston Testers on your next well.

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Midwest 1 Coblentz, SE SW NE 16-6n-22e, on the west side of Norris field in Latimer County, flowed 1,230 M.c.f.d. from Red Oak at 7,250 ft. Frankfort Oil Co. 1 Hulsey in NW NW SE 18-6n-22e flowed 1 M.M.c.f.d. on test of the Red Oak at 6,911-14 ft.

## Second dual oiler finaled in Fairway field

East Texas' Fairway field, one of this year's exploratory highlights in this province, gained its second dual oil completion. Well is Claud B. Hamil 1 Bessie Cook, Jose Cherino Survey, A-168, northeastern Anderson County.

The well flowed 451 bbl. of 48°-gravity oil per day from James lime and 115 bbl. of 40.5°-gravity oil per day from Massive anhydrite at perforations 10,060-80 and 9,513-19 ft., respectively. Chokes were 12/64-in. and 11/64-in. respectively.

The well is ¼ mile south of the first dual well in the field, also producing from James and Massive anhydrite. The 1 A. J. Wilkerson, a Fairway Operating Co. well in Jose Cherino Survey, A-168, was completed in March flowing 297 bbl. of 40.8°-gravity oil daily through 11/64-in. choke from Massive anhydrite perforations at 9,436-52 ft.

## Triple oil completion finaled in Texas' Winkler

In Texas, Sunray Mid-Continent Oil Co. has finaled a triple oiler in Winkler County.

The 17 M. J. Hill "23-A," Section 23 Block B-11 PSI Survey, flowed 274 bbl. of oil a day through 18/64-in. choke from perforations at 9,878-86 ft. opposite the Devonian, flowed 334 bbl. of oil a day through 18/64-in. choke from Fusselman perforations at 10,260-10,344 ft. and flowed 578 bbl. of oil a day from perforations at 12,120-25 ft. in the Ellenburger.

The hole was drilled to 12,126 ft. with 7-in. casing cemented at 11,935 ft.

In Nolan County, West Texas, Sunray completed the 4 Compton, Section 91 Block 1-A H&TC Survey, as a flowing oiler.

Tests gaged 180 bbl. of oil a day through 13/64-in. choke from Strawn perforations at 7,000-14 ft. Flowing tubing pressure registered 725 lb. Total depth was 7,150 ft. with 4½-in. casing cemented at 7,144 ft.

## Gas discoveries feature South Texas exploration

A Jackson County, Texas wildcat flowed 10,800 M.c.f.d. It is Welsh Oil & Gas Co. 1 George S. Gayle, 3 miles northeast of Edna, Tex.

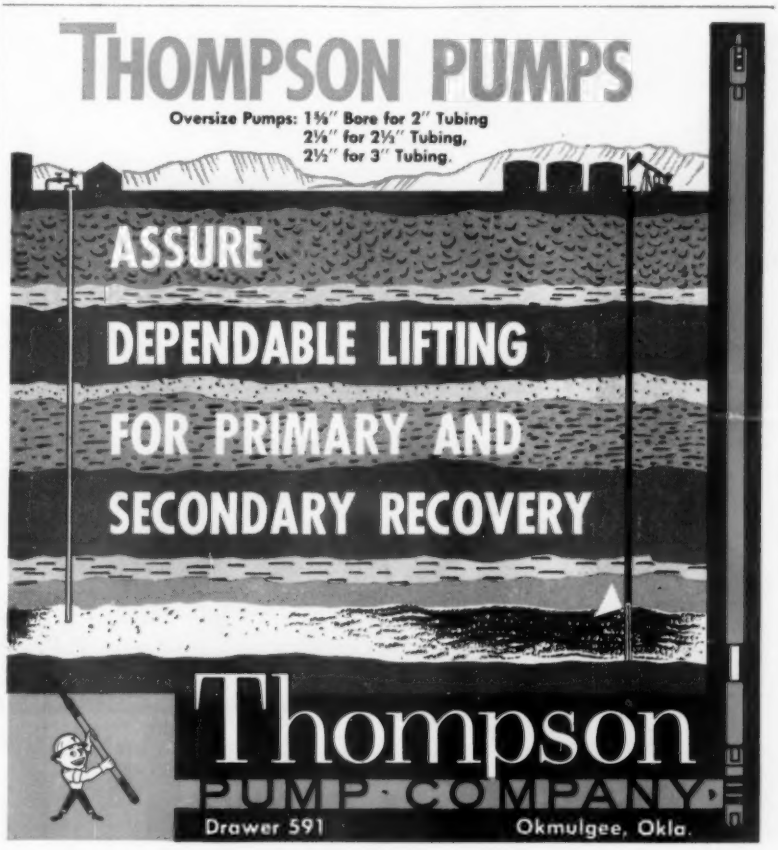
Production is from perforations at 5,697-5,702 ft. Location is in the Nestor Clay Survey, A-13. It lies 2 miles northeast of a lone gas producer at Cox & Hamon 1 Virginia Babb Wiley.

**Cow Trap.** Phillips Petroleum Co. completed 1 Tuna "A" as a dual gas discovery in Brazoria County's Cow Trap field. Two shallow Miocene sands were put on production. From 2,834-39 ft. the well tubing side made 165 M.M.c.f.d. Casing completion got 11,100 M.c.f.d. from perforations at 2,606-11 ft. Location is in the J. C. Carrington Survey, A-486, Matagorda County—surface location; bottom-hole spots in Tract 221-S of the Gulf of Mexico off Brazoria County.

## Two dry gassers added to new South Spanish Camp

Recently opened South Spanish Camp field in Wharton County on the Texas Gulf Coast has two dry gas discoveries. J. Newton Rayzor of Houston completed 1 Cloud as a dual dry gas strike of the field in March from 4,000-ft. and 4,700-ft. Yegua sands.

The 1 Marcial Sorrel II and 1 Dr. Lyle J. Logue, both dual dry gassers, were completed, opening three new pays in the field. The 1 Sorrel flowed 2,900 M.c.f.d. from 4,500-ft. Yegua sand perforations at 4,485-91-ft., from tubing. The casing zone of the well flowed 4,600 M.c.f.d. at 4,010-16 ft. from 4,000-ft. Yegua sand. Tubing completion of the 1 Logue made 5,500 M.c.f.d. from 4,850-ft. Yegua sand at 4,850-57½ ft. The casing zone of the well was good for 5,300 M.c.f.d. from 3,850-ft. Yegua sand at 3,850-57 ft. Location is 5 miles southwest of Hungerford, Tex., in the Stephen F. Austin League 3, A-3.

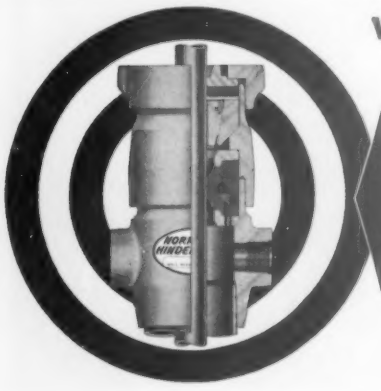


# April footage breakdown in U. S.

| | Field wells | | | | | Wildcats | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Oil | Cond. | Gas | Dry | Service | Oil | Cond. | Gas | Dry |
| Alabama | 22,991 | | | | | | | | 5,235 |
| Alaska | 22,214 | | | | | | | | |
| Arizona | | | | 1,082 | | | | | 4,224 |
| Arkansas | 40,048 | | 13,281 | 60,917 | 2,626 | 4,520 | | 4,157 | 13,696 |
| California | 262,455 | | 43,089 | 81,683 | 10,811 | | | 24,325 | 107,811 |
| Colorado | 37,866 | | 29,680 | 61,692 | | | | | 85,408 |
| Illinois | 68,717 | | 2,997 | 44,168 | 3,254 | | | | 22,768 |
| Indiana | 13,923 | | | 17,888 | 1,355 | | | | 22,777 |
| Kansas | 360,198 | | 55,681 | 206,480 | 39,559 | 39,558 | | 27,806 | 241,436 |
| Kentucky | 21,170 | | 141,658 | 100,771 | 2,525 | | | | 24,138 |
| Louisiana | 1,158,366 | 21,914 | 300,724 | 583,819 | | 6,009 | | 11,200 | 308,634 |
| North | 61,946 | | 36,864 | 68,300 | | 6,009 | | | 43,377 |
| South | 598,523 | 21,914 | 161,278 | 396,961 | | | | | 188,703 |
| Offshore | 497,897 | | 102,582 | 118,558 | | | | 11,200 | 76,554 |
| Michigan | 31,350 | | 14,937 | 37,076 | | | | 1,406 | 70,760 |
| Mississippi | 98,571 | 27,865 | 11,201 | 138,315 | | 9,400 | | | 74,395 |
| Missouri | | | | | | | | | 11,002 |
| Montana | 57,595 | | | 14,824 | | | | | 50,217 |
| Nebraska | 171,509 | | | 88,035 | | 30,999 | | | 144,172 |
| New Mexico | 364,138 | | 90,930 | 51,234 | | 11,410 | | 9,600 | 65,990 |
| West | 135,948 | | 75,314 | 14,709 | | | | | 21,401 |
| East | 228,190 | | 15,616 | 36,525 | | 11,410 | | 9,600 | 44,589 |
| New York | 19,875 | | | 2,650 | 14,575 | | | | |
| North Dakota | 79,696 | | | 18,356 | | | | | 30,688 |
| Ohio | 66,444 | | 27,892 | 37,078 | 48,834 | | | 3,410 | 1,131 |
| Oklahoma | 610,547 | 33,845 | 174,717 | 286,877 | 150,476 | 30,595 | 22,450 | 42,940 | 182,394 |
| Pennsylvania | 37,240 | | 100,720 | 34,990 | 41,161 | | | 18,248 | 50,151 |
| Tennessee | | | | | | 1,050 | | 1,910 | 7,505 |
| Texas | 2,272,278 | 426,162 | 271,223 | 861,915 | 52,124 | 102,527 | 42,935 | 37,748 | 934,455 |
| Dist. 1 | 117,395 | 16,894 | | 37,777 | 392 | | | | 56,651 |
| Dist. 2 | 120,264 | 78,665 | 28,526 | 77,620 | | | 7,915 | 6,862 | 115,943 |
| Dist. 3 | 218,939 | 81,455 | 35,151 | 158,784 | | | 9,718 | | 97,807 |
| Dist. 4 | 101,110 | 57,950 | 33,046 | 64,874 | 6,564 | | 7,415 | 19,064 | 96,796 |
| East | 246,341 | 70,292 | | 56,958 | | 13,144 | | | 59,092 |
| Dist. 7-B | 186,471 | 12,916 | 27,970 | 100,245 | 28,598 | 19,825 | | 11,822 | 119,696 |
| Dist. 9 | 236,320 | 43,518 | | 114,323 | 8,395 | 19,947 | | | 43,839 |
| West | 859,762 | 57,182 | 13,163 | 190,186 | 8,175 | 41,106 | | | 286,825 |
| Dist. 10 | 185,676 | 7,290 | 133,367 | 61,148 | | 8,505 | 17,887 | | 57,806 |
| Utah | 103,842 | | 7,288 | 17,194 | | | | 7,907 | 46,405 |
| Washington | | | | | | | | | 7,599 |
| W. Virginia | 7,544 | | 84,673 | 11,202 | 14,247 | | | | |
| Wyoming | 151,192 | | 27,823 | 55,257 | 6,195 | 4,393 | | | 119,162 |
| **Total April** | **6,079,769** | **509,786** | **1,398,514** | **2,813,503** | **387,742** | **240,461** | **65,385** | **190,657** | **2,632,155** |

## . . . and in Canada

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Total** | **502,679** | | **114,419** | **96,045** | **8,750** | **25,808** | | **34,670** | **108,035** |
| Alberta | 439,617 | | 107,196 | 77,878 | 8,750 | 21,754 | | 30,151 | 82,677 |
| Sask. | 54,420 | | 2,125 | 14,337 | | 4,054 | | | 6,015 |
| Manitoba | | | | | | | | | |
| B. C. | 8,642 | | 5,098 | 3,830 | | | | 4,519 | 17,035 |
| N. W. T. | | | | | | | | | 2,308 |

W. C. NORRIS

Target

ECONOMY • SERVICE • SAFETY

WRITE FOR NEW WELL HEAD BULLETIN P. O. BOX 1739, TULSA

TUBING & CASING HEADS

# National Supply has everything you need for Spring Clean-Up

You'll find it pays to use your National Supply store as a single source for all your Spring clean-up needs. With one order you can cover all your needs . . . paint, hose, water cans, rig wash, paper towels, rakes, brooms, brushes, etc.

You'll save time by eliminating the need for visits or calls to several suppliers. One-order delivery will simplify your inventory control. And you'll be pleased with the wide variety of products and famous name brands you'll find at National Supply. We stock over 65,000 products, each made by a leading manufacturer with an established reputation for quality and reliability. All products are carefully selected with your needs in mind.

There are 119 of these National Supply stores strategically located to serve you as efficiently as possible. Next time you buy, see National Supply.

# Why National units are today's

This is a National Supply pumping unit installed in West Texas. National pumpers are available in 13 basic sizes, with 148 standard specifications. Your National Supply representative can recommend a unit to meet your exact needs.

# best pumper investment

**LOW COST OPERATION.** All features and parts of National pumpers are designed to give you low cost installation and operation. For example, National Supply provides frictionless bearings that measurably reduce fuel consumption. Ask your National Supply representative to show you how these frictionless bearings will save you money.

**SPECIAL DESIGN FEATURES...at no extra cost.** You get many "extra" features in National pumpers without paying premium prices. The entire National line is competitively priced. Here are a few of the features that are standard in National pumpers:

**Accurate Counterbalancing.** Geometric and concentric design of cranks and counterweights allow accurate counterbalance, at a leading or lagging condition as well as at mid-stroke. Counterweights can be quickly and safely adjusted by one man.

**Two-Direction Gear Reducers.** National gear reducers can be rotated in either direction, permitting more latitude on prime mover placement. This extends the life of the reduction unit.

**Arc Hanger Design.** Arc hanger has a hinge that can be folded back for unhindered well servicing. Self-adjusting features prevent side loading, polished rod bending and excessive wear of stuffing box packing.

**Dust Seals.** National pumpers have dust excluders on all bearings to improve the life of oil seals and bearings. Dust seals on shafts rotate with, but do not touch, the shafts.

**Unmatched Stability.** National pumpers are less susceptible to twisting or stressing because of wide spacing of the samson post's four legs and cross bracing. Design distributes beam load evenly over entire foundation area.

National pumping units are available in 13 basic sizes with 148 standard specifications in beam and crank counterweighted types. They are structurally rated from 2,065 to 32,400 pounds on the walking beam. With this variation, there is never need to compromise on pumper size or rating. Ask your National Supply representative to recommend the ideal pumping unit to meet your specific requirements. Or write today for complete information from National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Pa.

Steel's Symbol of strength, long life, and economy

Steel

The J-50 triplex pump has an integral suction pulsation dampener extending the full length of the fluid end, directly below the suction valves for maximum efficiency.

# NEW NATIONAL J-50 TRIPLEX PUMP

## for water flooding, power oil service and salt water disposal

The new National horizontal triplex pump is rated at 50 input horsepower for many applications such as water flooding, salt water disposal and power oil service.

You get low initial cost, plus a proven ruggedness and smooth operation with the J-50 triplex pump. Some of the many features are the built-in suction dampener, lightweight aluminum alloy connecting rods, and double extension crankshaft. A special fluid end can be specified for power oil service.

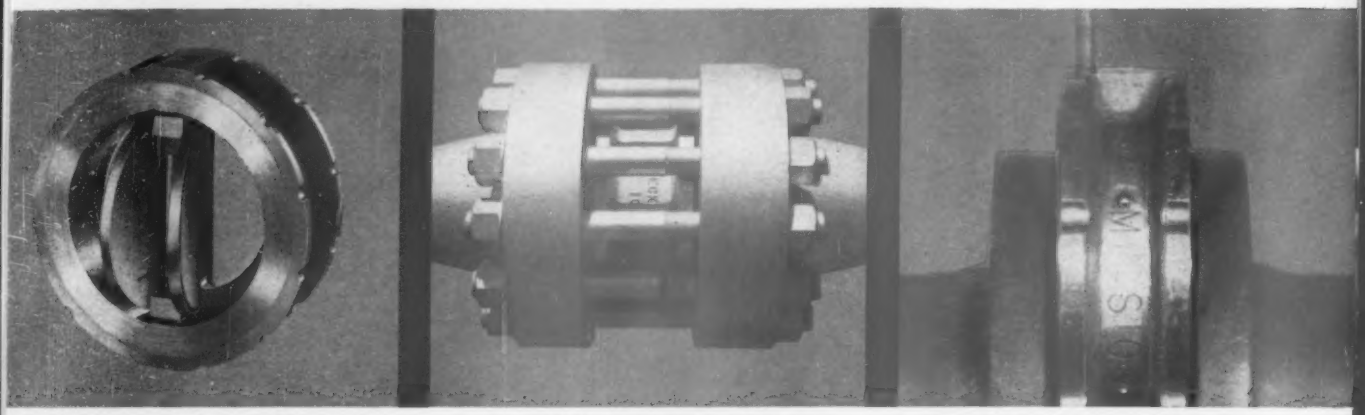
The J-50 triplex is available in three models: the J-50L and J-50M for low and medium pressures in corrosive and noncorrosive service, and the J-50PO for power oil service. Write for free literature on this versatile new pump to National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Pa.

ARMCO National Supply Division

# April completions drop to 3,496; 1961 to date is 14,699

| State— | All wells | | | | | | | | | | | Wildcats | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | Oil | Cond. | Gas | Dry | Service | Footage | Cum. wells 1961 | Cum. footage 1961 | Cable-tool comp. | D.D. | Total | Oil | Cond. | Gas | Dry | Footage | Cum. wells 1961 | Cum. footage 1961 |
| Alabama | 3 | 2 | 0 | 0 | 1 | 0 | 28,226 | 20 | 230,651 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 5,235 | 4 | 46,791 |
| Alaska | 2 | 2 | 0 | 0 | 0 | 0 | 22,214 | 10 | 106,396 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 12,135 |
| Arizona | 4 | 0 | 0 | 0 | 4 | 0 | 5,306 | 8 | 15,721 | 0 | 0 | 3 | 0 | 0 | 0 | 3 | 4,224 | 6 | 13,369 |
| Arkansas | 37 | 12 | 0 | 4 | 20 | 1 | 139,245 | 176 | 654,228 | 0 | 0 | 6 | 1 | 0 | 1 | 4 | 22,373 | 33 | 130,943 |
| California | 135 | 88 | 0 | 11 | 32 | 4 | 530,174 | 568 | 2,449,588 | 0 | 9 | 22 | 0 | 0 | 4 | 18 | 132,136 | 89 | 535,280 |
| Colorado | 44 | 10 | 0 | 5 | 29 | 0 | 214,646 | 205 | 987,416 | 0 | 1 | 16 | 0 | 0 | 0 | 16 | 85,408 | 106 | 507,696 |
| Florida | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 68,620 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 68,620 |
| Georgia | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4,500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4,500 |
| Illinois | 68 | 26 | 0 | 1 | 40 | 1 | 141,904 | 534 | 1,060,141 | 19 | 4 | 22 | 0 | 0 | 0 | 22 | 22,768 | 113 | 175,932 |
| Indiana | 35 | 10 | 0 | 0 | 24 | 1 | 55,943 | 191 | 273,943 | 16 | 1 | 13 | 0 | 0 | 0 | 13 | 22,777 | 49 | 61,511 |
| Kansas | 359 | 174 | 0 | 22 | 138 | 25 | 970,718 | 1,718 | 4,161,181 | 122 | 2 | 77 | 10 | 0 | 5 | 62 | 308,800 | 334 | 1,310,177 |
| Kentucky | 165 | 26 | 0 | 46 | 89 | 4 | 290,262 | 517 | 797,458 | 70 | 6 | 20 | 0 | 0 | 0 | 20 | 24,138 | 60 | 74,146 |
| Louisiana | 279 | 141 | 2 | 32 | 104 | 0 | 2,390,666 | 1,177 | 9,507,999 | 0 | 1 | 34 | 1 | 0 | 1 | 32 | 325,843 | 172 | 1,614,881 |
| North | 62 | 29 | 0 | 9 | 24 | 0 | 216,496 | 378 | 1,320,058 | 0 | 0 | 10 | 1 | 0 | 0 | 9 | 49,386 | 64 | 324,733 |
| South | 137 | 64 | 2 | 12 | 59 | 0 | 1,367,379 | 605 | 6,175,878 | 0 | 1 | 16 | 0 | 0 | 0 | 16 | 188,703 | 93 | 1,117,501 |
| Offshore | 80 | 48 | 0 | 11 | 21 | 0 | 806,791 | 194 | 2,012,063 | 0 | 0 | 8 | 0 | 0 | 1 | 7 | 87,754 | 15 | 172,647 |
| Michigan | 47 | 10 | 0 | 6 | 31 | 0 | 155,529 | 217 | 705,745 | 34 | 0 | 21 | 0 | 0 | 1 | 20 | 72,166 | 90 | 280,096 |
| Mississippi | 36 | 10 | 3 | 1 | 22 | 0 | 359,747 | 173 | 1,754,753 | 0 | 0 | 8 | 1 | 0 | 0 | 7 | 83,795 | 57 | 581,977 |
| Missouri | 8 | 0 | 0 | 0 | 8 | 0 | 11,002 | 22 | 39,219 | 1 | 0 | 8 | 0 | 0 | 0 | 8 | 11,002 | 21 | 37,825 |
| Montana | 20 | 10 | 0 | 0 | 10 | 0 | 122,636 | 124 | 688,045 | 0 | 0 | 7 | 0 | 0 | 0 | 7 | 50,217 | 53 | 330,276 |
| Nebraska | 96 | 50 | 0 | 0 | 46 | 0 | 434,715 | 287 | 1,314,235 | 0 | 5 | 36 | 6 | 0 | 0 | 30 | 175,171 | 117 | 565,100 |
| Nevada | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 17,350 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 9,595 |
| New Mexico | 127 | 74 | 0 | 16 | 37 | 0 | 593,302 | 563 | 2,861,040 | 33 | 0 | 24 | 2 | 0 | 1 | 21 | 87,000 | 108 | 530,037 |
| West | 63 | 28 | 0 | 12 | 23 | 0 | 247,372 | 225 | 1,083,348 | 19 | 0 | 15 | 0 | 0 | 0 | 15 | 21,401 | 36 | 78,571 |
| East | 64 | 46 | 0 | 4 | 14 | 0 | 345,930 | 338 | 1,777,692 | 14 | 0 | 9 | 2 | 0 | 1 | 6 | 65,599 | 72 | 421,466 |
| New York | 28 | 15 | 0 | 0 | 2 | 11 | 37,100 | 124 | 185,256 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 24,066 |
| North Dakota | 22 | 12 | 0 | 0 | 10 | 0 | 128,740 | 76 | 463,414 | 0 | 0 | 6 | 0 | 0 | 0 | 6 | 30,688 | 19 | 138,643 |
| Ohio | 74 | 23 | 0 | 10 | 17 | 24 | 184,789 | 337 | 836,674 | 71 | 1 | 2 | 0 | 0 | 1 | 1 | 4,541 | 13 | 40,325 |
| Oklahoma | 476 | 220 | 7 | 41 | 142 | 66 | 1,534,841 | 1,995 | 6,503,034 | 131 | 5 | 46 | 5 | 2 | 6 | 33 | 278,379 | 203 | 1,089,248 |
| Oregon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9,579 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9,579 |
| Pennsylvania | 90 | 20 | 0 | 31 | 15 | 24 | 282,510 | 250 | 793,873 | 75 | 0 | 10 | 0 | 0 | 3 | 7 | 68,399 | 19 | 132,742 |
| South Dakota | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8,924 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8,924 |
| Tennessee | 11 | 0 | 0 | 3 | 8 | 0 | 10,465 | 23 | 15,063 | 11 | 0 | 11 | 0 | 0 | 3 | 8 | 10,465 | 23 | 15,063 |
| Texas | 1,180 | 592 | 55 | 65 | 436 | 32 | 5,001,367 | 4,627 | 20,523,356 | 29 | 29 | 237 | 18 | 5 | 6 | 208 | 1,117,665 | 962 | 4,711,551 |
| District 1 | 96 | 56 | 2 | 0 | 34 | 4 | 229,109 | 295 | 841,475 | 6 | 0 | 19 | 0 | 0 | 0 | 19 | 56,651 | 98 | 401,011 |
| District 2 | 62 | 16 | 10 | 7 | 29 | 0 | 435,795 | 228 | 1,626,995 | 0 | 0 | 19 | 0 | 1 | 1 | 17 | 130,720 | 52 | 366,062 |
| District 3 | 90 | 36 | 9 | 7 | 38 | 0 | 601,854 | 349 | 2,461,280 | 0 | 1 | 13 | 0 | 1 | 0 | 12 | 107,525 | 70 | 636,266 |
| District 4 | 69 | 21 | 8 | 7 | 30 | 3 | 386,819 | 385 | 2,191,855 | 0 | 4 | 17 | 0 | 1 | 2 | 14 | 123,275 | 84 | 486,094 |
| East (5 and 6) | 98 | 64 | 8 | 0 | 26 | 0 | 445,827 | 370 | 1,815,916 | 0 | 2 | 15 | 1 | 0 | 0 | 14 | 72,236 | 79 | 381,871 |
| District 7-B | 185 | 76 | 3 | 12 | 80 | 14 | 507,543 | 662 | 1,977,893 | 8 | 8 | 45 | 6 | 0 | 3 | 36 | 151,343 | 187 | 664,373 |
| West (7-C and 8) | 290 | 171 | 5 | 2 | 109 | 3 | 1,456,399 | 1,153 | 5,827,448 | 15 | 12 | 80 | 6 | 0 | 0 | 74 | 327,931 | 262 | 1,227,032 |
| District 9 | 186 | 107 | 7 | 0 | 64 | 8 | 466,342 | 761 | 1,902,862 | 0 | 2 | 18 | 4 | 0 | 0 | 14 | 63,786 | 94 | 296,392 |
| District 10 | 104 | 45 | 3 | 30 | 26 | 0 | 471,679 | 424 | 1,877,632 | 0 | 0 | 11 | 1 | 2 | 0 | 8 | 84,198 | 36 | 252,450 |
| Utah | 31 | 17 | 0 | 3 | 11 | 0 | 182,636 | 93 | 533,231 | 0 | 2 | 9 | 0 | 0 | 1 | 8 | 54,312 | 38 | 218,392 |
| Washington | 2 | 0 | 0 | 0 | 2 | 0 | 7,599 | 5 | 18,650 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 7,599 | 5 | 18,650 |
| West Virginia | 54 | 4 | 0 | 38 | 5 | 7 | 117,666 | 303 | 737,186 | 54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 14,737 |
| Wisconsin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 8,100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 8,100 |
| Wyoming | 63 | 28 | 0 | 6 | 28 | 1 | 364,022 | 331 | 1,721,424 | 0 | 3 | 19 | 1 | 0 | 0 | 18 | 123,555 | 124 | 673,793 |
| **Total April** | **3,496** | **1,576** | **67** | **341** | **1,311** | **201** | **14,317,970** | **14,699** | **60,055,993** | **694** | **69** | **660** | **45** | **7** | **33** | **575** | **3,128,656** | **2,852** | **13,994,700** |
| Total March | 4,048 | 1,887 | 63 | 416 | 1,401 | 281 | 16,673,504 | ..... | ..... | 801 | 78 | 767 | 61 | 8 | 44 | 654 | 3,830,567 | ..... | ..... |
| **Cumulative 1961** | **14,699** | **6,684** | **301** | **1,457** | **5,319** | **938** | **60,055,993** | ..... | ..... | **2,909** | **285** | **2,852** | **228** | **34** | **139** | **2,451** | **13,994,700** | ..... | ..... |
| Cumulative 1960 | 13,834 | 6,444 | 449 | 1,143 | 5,376 | 422 | 60,775,352 | ..... | ..... | ..... | ..... | 3,029 | 266 | 32 | 94 | 2,637 | 13,980,801 | ..... | ..... |

# COSTS LESS—WEIGHS LESS—EASY TO INSTALL

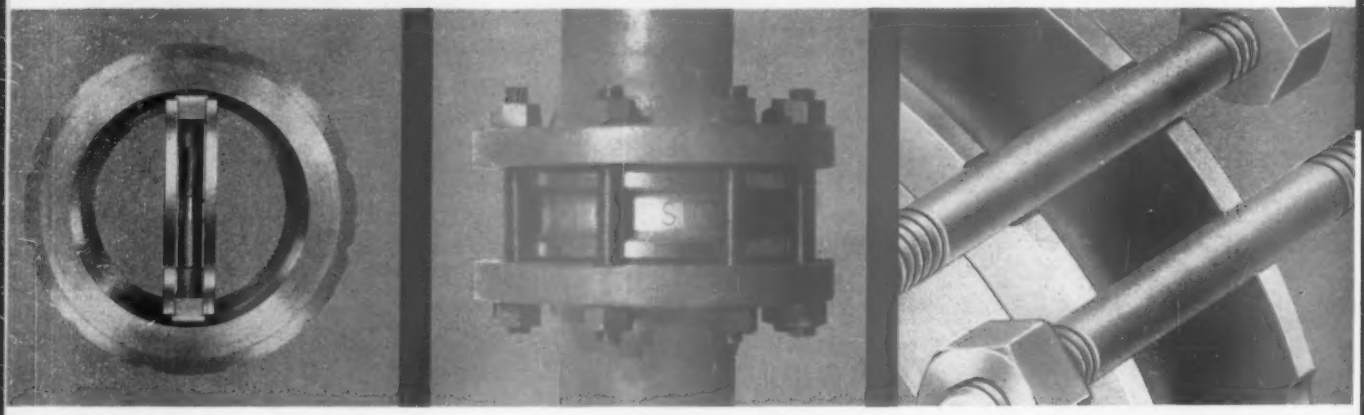


Because of its sound, imaginative design, the Duo-Chek check valve is smaller, uses less material, and costs less to buy. It costs less to maintain and lasts longer, too.

A Duo-Chek check valve weighs on the average less than ten per cent, with some models weighing only two per cent, as much as conventional check valves for the same service. No foundations are needed.

The Duo-Chek fits between the flanges, is smaller and weighs less. For example, a 6-inch steel valve, series 300, weighs 29 lbs., requires no special installation equipment.

# NO SLAM—ANY POSITION—CUTS INVENTORY



A stainless steel coil spring effects positive sealing action. The quick action of the spring closes the valve before reverse flow can occur. Result: No slam, no water hammer.

The Duo-Chek simplifies piping arrangements. The spring loaded plates operate in any position. Most popular sizes can be installed even in vertical lines with downward flow.

The unique versatility of the Duo-Chek greatly reduces inventory. In sizes 2 through 12 inch, one valve fits both series 150 and 300 flanges; 2- and 3-inch sizes fit series 600, too.

# MISSION **DUO-CHEK** CHECK VALVE

The Mission Duo-Chek® check valve performs all regular check valve duties, yet is smaller, lighter, and easier to install. Duo-Chek check valves are available in a complete range of sizes from 2 to 48 inches, ASA Series 125 through 2500. They come in various end connections, such as raised face, ring joint, weld neck, etc. They are made in carbon steel, stainless steel, aluminum, and bronze. Special alloys are available. Because of the small size of the Duo-Chek, special alloy valves cost much less than conventional valves in the same alloy.

Sealing material is bonded in a groove in the plate. The sealing material makes an O-ring seal, which pressure deforms until metal-to-metal contact is made by the plate and body seat. Sealing material may be Buna-N, Teflon, Viton, or metal, depending on the service.

The simplicity of design of the Duo-Chek pays off in every installation with longer life and less maintenance. Only six parts are contained within the body of the Duo-Chek, held without the use of internal fasteners or joints of any kind. All parts are interchangeable.

The Duo-Chek is much lighter in weight than conventional check valves, yet is stronger. By dividing the opening, the unsupported plate area is reduced so that each plate requires only one-eighth of the weight of a conventional clapper of the same strength. The short stocky body is inherently stronger and more rigid than a short length of heavy wall pipe.

Whatever your check valve application, the Mission Duo-Chek can cut initial purchase and installation costs, cut maintenance costs from then on. Contact Mission now for a representative.

MISSION VALVE AND PUMP CO. A SUBSIDIARY OF MISSION MANUFACTURING CO. P. O. Box 4209, Houston, Texas • Cable Address 'MISSCO' • Export Office: 30 Rockefeller Plaza, New York • In the United Kingdom: MISSION MANUFACTURING CO., LTD., 1 Hanover Square, London W. 1 England • Cable Address 'MISSOMAN' • Sold by Mission Manufacturing Company outside of Canada and the U.S.A.

MISSION VALVE AND PUMP CO.

# Steiniger Will Hold the Line

**. . . on broad policy in his new post as chief executive officer of Sinclair. But he may try different approach.**

EDWARD L. Steiniger, president of Sinclair Oil Corp., may bring a new style to the chief executive officer's job to which he has just been elected.

But he will operate under the broad policy used by his predecessor, P. C. Spencer, who continues as chairman of the company. Spencer also is chairman of a new executive committee.

Steiniger has been president of Sinclair since 1958. He was designated chief executive officer as well by the board following the annual company meeting in Houston.

"No two individuals approach the same problem in the same way," he points out in commenting on possible policy changes. "Yet I will be seeking the same results that our company has been working toward for the last 3 years with the sound program that is already in effect."

**Edward L. Steiniger**
. . . foreign experience is invaluable.

**Steiniger's goals . . .** The goals in general are to increase oil and gas production, expand in petrochemicals, and step up marketing in profitable areas while withdrawing from marginal areas.

How will these goals be met?

"We are simply going to go out and work and sell," Steiniger says. "The honeymoon in marketing—if there ever was one—is over."

The key to success, he feels, is having the right people in the right job. So you can expect Sinclair to continue to pay a great deal of attention to personnel.

"We are going to see that we have the best people we can find," the new chief executive promises. "We will change them around as conditions require in order to keep top people in the right spot."

**Venezuelan career . . .** Steiniger's own career has been strongly oriented toward foreign operations, mainly in Venezuela.

A business-administration major at Pace College and New York University, he joined Sinclair in 1925 at the age of 23. He was first an office assistant in the exploration affiliate.

Three years later he was off to Venezuela, where Sinclair was surveying and testing oil concessions in the early stages of the country's petroleum development. This preliminary work resulted in discoveries which now make an important contribution to Sinclair production.

Steiniger returned to New York to coordinate operations between the home office and Venezuela as exploration entered the drilling stage. He went back to Venezuela in September 1940 as vice president of Venezuelan Petroleum Co., the Sinclair subsidiary.

During the next few years fields were opened and developed. This meant construction of pipelines, field-processing plants, and a refinery. In 1950 he returned to New York as president of Venezuelan Petroleum Co.

A new responsibility, selling products of the refinery he had just built, rounded out his experience. Perhaps the climax to the Venezuelan efforts came in 1953 when the big Barinas field was discovered.

**Experience bears fruit . . .** Being able to work in foreign operations—especially in exploration and production—is invaluable in a man's professional development, Steiniger feels.

"When you're abroad and a long way from the home office, you're more nearly on your own," he explains. "You have to deal with all manner of problems. You either make it or you don't."

The foreign experience had a lot to do with the making of Steiniger. During this period he had to cope with business problems arising from seven revolutions, the formation of unions, imposition of an income tax, and the advent of modern petroleum and labor laws.

In 1955, Steiniger was made vice president of the parent company in charge of foreign operations in Venezuela, Ethiopia, Somalia, and later in Paraguay and the Sahara.

In 1957 he was elected executive vice president and in the following year he was made president.

## ▶▶▶ Personals

**T. S. Petersen,** president and a director of Standard Oil Co. of California, has been elected a director of Lehman Corp., New York City.

**Dr. Robert G. Larsen** has been named oil research and development consultant at Shell Development Co.'s Emeryville, Calif., research center. Larsen has been manager of Shell's Thornton research center near Chester, England, since 1959. He will take over the Emeryville post August 1.

**Dr. Robert J. Rosscup** has been transferred by American Oil Co. from Whiting, Ind., to Texas City, where he will be group leader in the research section, research and development department.

**Marion Phillips,** geologist with Kewanee Oil Co., has been transferred to Denver from Wichita.

**John R. Lishman, Ian A. P. Rumsey,** and **James R. Metcalfe** have been named professional specialists by California Standard Co. Lishman will be specialist for formation evaluation and Rumsey, specialist for photogeology. Metcalfe is tax supervisor.

**THREE VETERAN MARKETERS** honored for their contributions to API at the marketing division's Miami Beach sessions were, left to right, R. Cubicciotti of Witco Chemical Co., New York, former chairman of the lubrication committee; Willard W. Wright, Sun Oil Co., Philadelphia, chairman of the service-station advisory committee; and J. L. Minner, Shell Oil Co., New York, who served as chairman of the fuel-oil committee.

**William N. Mosher,** chief geologist for Hiawatha Oil & Gas Co. in Midland, Tex., has joined Frankfort Oil Co. in Midland as division geologist and Midland manager.

**W. W. Keeler,** executive vice president of Phillips Petroleum Co., will receive a special citation for achievement during University of Kansas commencement ceremonies June 5. Keeler is a 1932 graduate of the school. He will be one of five alumni receiving the award.

**J. Henry Blackburn,** Sunray Mid-Continent Oil Co., has been elected president of the Society of Professional Well Log Analysts. **Joe D. Owen,** Phillips Petroleum Co., has been named technological vice president, and **Gene Griffith,** Sinclair Oil & Gas Co., is membership vice president.

**Frank Walsh,** assistant head of the supply and distribution department at Humble's Bayway refinery, Linden, N. J., has been named assistant head of the technical department. **Jim Driscoll,** assistant head of the mechanical department, will replace Walsh. **John Van Schen** will succeed Driscoll. **Ted Jeffers,** head of the alcohol division, will succeed Van Schen as assistant head of the petroleum products department. **Lewis King** will succeed Jeffers. **Don Schlotterbeck,** unit supervisor in the alcohol division, has been named unit supervisor, ethylene unit.

**Charles G. Faubion,** district geophysicist with Libyan Atlantic Co. in Tripoli, Libya, has been transferred to London.

**P. L. Vander Jagt** has been named managing director of Amoco Italia S.p.A., Italian refining and marketing affiliate of Standard Oil Co. (Ind.). Vander Jagt has been marketing manager for American Oil Co.'s Salt Lake City region.

**John S. Boldrick,** operations superintendent of Humble's Midland, Tex., area, has been transferred to Houston as area production manager. **Charles S. Yust,** operations superintendent in the North Texas area office, Wichita Falls, has been named Houston area operations superintendent. **R. W. Bybee,** Midland area exploration manager, has been transferred to Houston as planning and evaluation coordinator in the exploration department there. **W. W. Clark,** area geophysicist in Denver, has been named assistant to the regional geophysicist in Humble's Tulsa office. **R. M. Tesar,** staff geophysicist in Tulsa, has moved to Denver as assistant to the area geophysicist.

**Henry Thomas** has been promoted to mechanical engineering associate for Ethyl Corp. in Baton Rouge.

**Thomas P. Shaw,** junior engineer with Sinclair Oil & Gas Co., has been transferred to Tulsa from Denver.

**Henry L. Rase, Jr.,** Gulf Oil, has been elected president of Denver Geophysical Society. Other new officers are **W. T. Hasbrouck,** Colorado School of Mines, vice president, and **O. H. Armstrong,** Mobil Oil Co., secretary-treasurer.

**Herbert C. Smith,** formerly vice president and geophysicist for Reynolds-Southwestern Corp. of Houston, has opened offices as consulting geologist and geophysicist in Houston.

**Rear Admiral Thomas L. Becknell** has been named to succeed **Rear Admiral O. P. Lattu** as director of the Defense Department's Military Petroleum Supply Agency. Lattu is slated to become inspector general of the Navy's supply corps. Becknell is now in charge of the Navy's Pearl Harbor supply center.

New appointments in Humble's New Orleans area include, on the exploration staff, **J. L. Hudgins,** area geologist; **G. O. Morgan,** area geophysicist; **C. D. Hogue,** area scout; and **L. A. Farmer, Jr.,** area land man. In the production department, **E. E. Byrd** is area operations superintendent; **R. S. Sullins,** area engineering coordinator; **M. O. Pattison,** area civil engineer; **W. D. Clift,** area production engineer; and **Norman Newsome,** area reservoir engineer. In the area marketing department, **H. D. Monroe** has been named assistant manager. Heading four production districts within the New Orleans area will be **H. Durst III,** Harvey, La.; **J. G. Walvoord,** Grand Isle, La.; **E. E. Marshall,** Morgan City, La.; and **J. P. Nolley,** New Iberia, La. **E. G. Copley** is superintendent of the Opelousas, La., gas plant. Marketing district managers will be **T. B. Miller,** Shreveport, La.; **W. A. Nichols,** Baton Rouge; and **J. A. Lightfoot,** New Orleans. **E. A. Simmons** will be assistant New Orleans district manager.

# ▶▶▶ Personals

**Wallace E. Avery,** who recently became vice president in charge of West Coast operations for Texaco, has been elected to the board and executive committee of Western Oil and Gas Association. Avery was secretary of Texaco before taking the Los Angeles post.

**Hershel Evans,** senior engineer for Service Pipe Line Co. in Casper, Wyo., has been promoted to division schedule coordinator in Casper. **Lewis Byrd,** oil-movements coordinator in Casper, has been transferred to Wichita as division schedule coordinator. **Morrison Hynd,** senior engineer in Rawlins, Wyo., has been promoted to division schedule coordinator in Galesburg, Ill. **Patrick Murphy,** senior engineer in Shawnee, Okla., has been named schedule coordinator there.

**P. B. Mitchell,** engineer for United Gas Pipe Line Co. in Carthage, Tex., has been temporarily transferred to Longview, Tex.

**Robert R. Park,** analyst in Texas Eastern Transmission Corp.'s coordinating and planning department, Houston, has been named manager of gas market research. He will continue to headquarter in Houston.

**Henry F. Keith** has been elected a vice president of Texas Gas Transmission Corp. **George W. Anders** and **Richard C. Young** have been named to the new post of staff assistant to the president. Anders will work with financial relations and Young with diversification projects.

**Howard W. McCullough** has joined Texas American Oil Corp., Midland, Tex., as senior vice president.

**Olen Lane,** vice president of Continental Oil Co. in Los Angeles, has retired after 38 years with the company. Lane had been production superintendent, exploration manager and assistant general manager of the western region before becoming regional general manager and vice president in 1953.

**John A. Stich,** Gulf Oil Corp., has been elected president of American Society of Lubrication Engineers.

**C. R. Appledorn,** senior production engineer for Continental Oil Co. in Midland, Tex., has been transferred to Roswell, N. M., in the same capacity.

**Dr. James H. McGuirt** has resigned as a vice president of Austral Oil Co. to become an independent consultant in Houston. He will continue to be consultant to Austral.

**C. E. Smith, Jr.,** operations adviser to Humble's manufacturing division manager in Houston, has been named manager of the division's special-products plant, Houston.

**R. W. Miller,** New Orleans, has been transferred to Casper, Wyo., by Gulf Oil Corp. as area exploration manager. **J. D. McKay,** petroleum enginer in Denver, has been named Casper area engineer. He succeeds **Haynes L. Strider,** who has been named superintendent of drilling for Bolivian Gulf Oil Co., an affiliate.

**Warren C. Wilson,** product manager of Enjay Chemical Co.'s Paramins division, has been named head of the new petrochemicals department of Svenska Esso AB, Swedish affiliate. **Stephen L. Wythe,** who recently was named assistant director of Esso Research & Engineering Co.'s products-research division, will succeed Wilson with Enjay.

**W. D. Maxwell** has been named operations superintendent for Humble's Jackson, Miss., area production staff. **R. M. Pitcher** has been named area engineer, production. **R. W. Parks** will be reservoir engineer and **R. S. Rugeley,** production engineer. On the Jackson exploration staff, **Robert Beall** has been named area geologist; **L. A. Markeley** is area geophysicist; **R. W. Verkins** is area scout; **W. M. Selvidge,** area land man; **C. C. Keating,** head of production geology; **F. B. St. John III,** head of exploration geology; **W. H. Wise,** area log analyst; **S. R. Marsh,** area operations supervisor, geophysics; and **J. M. Watson,** area interpreter.

**B. R. Dorsey,** a senior vice president of Gulf Oil Corp., has been elected a director of Callery Chemical Co.

**R. O. Wilson,** manager of Cosden Petroleum Corp.'s asphalt division, has been transferred to Dallas from Arlington, Tex.

**Olan Runnels,** crude-oil representative for Shell Oil Co.'s Denver area, has been transferred to Houston as assistant manager of transportation and supplies in the crude-oil department. **Tracy B. Medders,** crude-oil representative in New Orleans, will succeed Runnels in Denver.

**Ford M. Graham,** vice president of Louisiana Land & Exploration Co., has been elected president. **John G. Phillips** has been elected a vice president and will continue as treasurer. **E. J. Langhetee, Jr.,** chief petroleum engineer, has been named assistant to the president. Graham, a former vice president of Monterey Oil Co., became vice president of Louisiana Land in April 1960.

GRAHAM

**Thomas D. Barrow** has been named southwest regional geologist for Humble Oil & Refining Co. **Ralph W. Garrett** has been named reserves and evaluation manager in the region's exploration department. Barrow had been eastern area exploration geologist, southwest region. Garrett was assistant eastern area geologist.

**Dr. P. Edward Byerly** has joined California Research Corp.'s La Habra, Calif., laboratory as research geophysicist. He had been with USGS in Washington. **Charles E. Moran** has joined the Cal Research Richmond, Calif., laboratory as research chemist in petroleum products. **Denis S. Skeie** has joined the Richmond staff as research chemist, chemicals section.

## Personals

**M. D. Fyfe** has been named assistant to the vice president of Shell Oil Co.'s New Orleans area. He succeeds **E. J. McLain,** who has retired.

**R. E. Old, Jr.,** general manager of Stekoll de Venezuela since 1958, has opened consulting offices in Telephone, Tex. Old was with Iranian Oil Exploration & Producing Co. and Iranian Oil Refining before joining Stekoll.

**Earl C. Thomas** has joined Index Geophysical Surveys Corp., Houston and Dallas, as geophysical supervisor and staff coordinator of operations.

**R. D. Anding,** head of process enginering at Humble's Baton Rouge refinery, has been named assistant manager of the crude and product-coordination department there. He succeeds **L. T. Ellis,** who has transferred to the manufacturing-coordination staff in Houston. **H. E. McBrayer,** head of the petroleum technical-service department, will succeed Anding.

**John Buthod,** engineer with Victor Drilling, has been transferred to Denver from Evansville, Ind.

**J. H. (Tarz) Marsh,** chief land man for Humble's central region in Tulsa, has retired after 31 years with the company.

**Emiliano Camargo,** district manager for Mobil Oil de Colombia in Bogota, has been named marketing manager in Uruguay for Mobil International Oil Co.

**J. W. Newcombe,** product sales manager for petroleum chemicals and functional fluids in Monsanto Chemical Co.'s organic chemicals division, has been named petroleum chemicals specialist, a new position in the division. **George R. Buchanan,** associate product sales manager for petroleum chemicals, will succeed Newcombe.

**J. D. Langston** has been named Denver area geologist for Humble. **L. A. Dodd** has been named Denver area land man, with **W. A. Crutcher** as area scout. **W. H. Dawson** will move from Billings, Mont., to Denver as area geophysicist.

**Warren N. Pearce,** district geophysicist for Texaco, has been elected president of the Casper, Wyo., Geophysical Society. He succeeds **Herb Dodson,** Atlantic Refining Co. Other new officers are **Marvin A. Buskala,** Superior Oil Co., vice president; and **W. L. Holloway,** Geophysical Library Co., secretary-treasurer.

**H. S. King,** manager of production in West Virginia for South Penn Oil Co., has been elected vice president in charge of West Virginia production. He succeeds **G. Allan Reid,** who is retiring. Reid will continue as a consultant to the company. King is a former vice president of South Penn Natural Gas Co., an affiliate.

**W. F. Knode,** Calgary, and **W. R. Persons,** St. Louis, have been elected directors of Plymouth Oil Co. Knode is president of Grizzly Petroleum, Ltd., and vice president and a director of Rector Well Equipment Co. and Pamoil, Ltd. He is a former chairman of the Alberta Oil and Gas Conservation Board. Persons is president of Emerson Electric Manufacturing Co.

## Deaths

**Wilfred Hoy Geis,** 68, Los Angeles consulting geologist and independent producer, died May 20 in a Houston hospital, where he had gone last month for surgery. Geis was a past president of Western Oil and Gas Association and past chairman of AIME's petroleum division. He was a vice president of Continental Oil Co. and had also been with Union Oil Co. before becoming a consultant. In 1956, Geis served as chairman of the California Committee Opposed to Oil Monopolies, a group formed by independents to fight Proposition 4, a bill which would have provided for compulsory unitization, well spacing and production regulations.

**S. B. Fowler,** president of Fowler Petroleum, Inc., Denver, died May 15 in a Washington, D. C., hospital. Fowler had been with Ashland Oil & Refining Co. and the old Mid-Continent Petroleum Corp., Stanolind Oil Purchasing Co., and Wood River Oil & Refining Co., before organizing his own firm in 1955.

**William H. Lothmann,** 72, right-of-way man for Northern Natural Gas Co., died May 15 in Salina, Kans., after a heart attack.

**Ralph D. Head,** 61, purchasing agent for Kerr-McGee Oil Industries in Oklahoma City, died May 13 in an Oklahoma City hospital.

**Howard P. Bowersox,** 57, drilling foreman for Sun Drilling Co., Los Angeles, was killed May 15 in an auto accident near Bakersfield, Calif.

**Kenneth F. Carter,** 53, assistant secretary and assistant treasurer of California Oil division of California Oil Co., died May 10 in a New Orleans hospital.

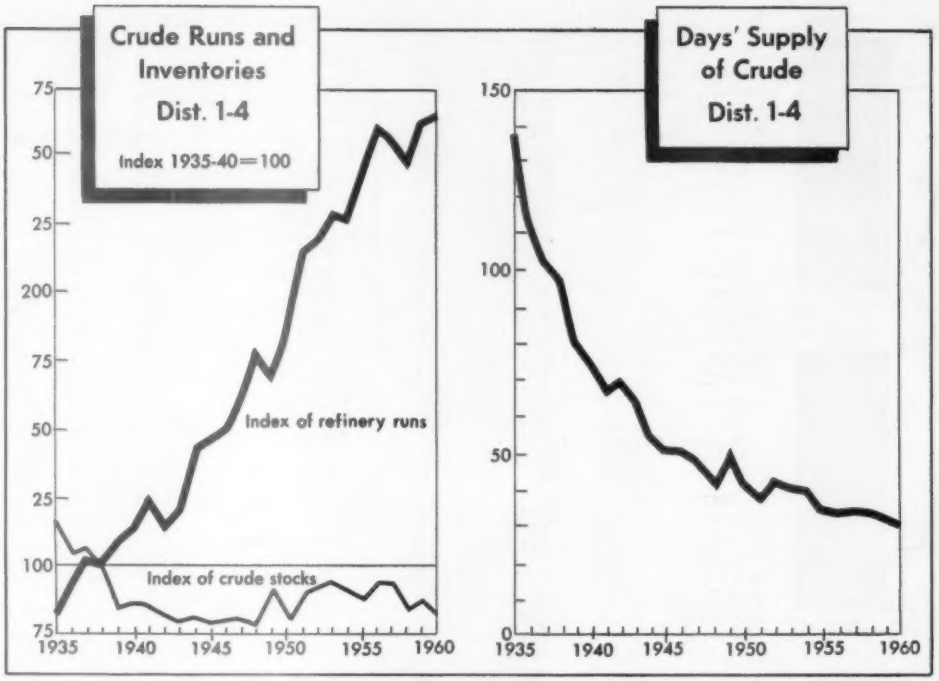
**Frank H. Bacon,** 65, retired general attorney for Cities Service Oil Co., was killed May 17 in an auto accident. Bacon retired in February after 25 years with Cities Service.

**William J. Mitchell,** 67, Oklahoma City drilling contractor, died May 7 in an Oklahoma City hospital after a long illness.

**William E. Shackelford,** 57, assistant superintendent for McAlester Fuel Co., was killed May 11 in an oil field accident near Longview, Tex.

**Walter J. Ruby,** 68, retired president of Marquette Petroleum Products, Chicago, died May 9 at his home in Chicago after a heart attack. Ruby retired in 1959 after 24 years with Marquette.

**Ross W. Coe,** 68, Ardmore, Okla., independent operator, died May 23 in Ardmore. Coe had been active in southern and central Oklahoma fields.




**LINES** on charts give a general picture of changes in crude stocks and refinery runs over the past 25 years for Districts 1-4.

Lines on the left chart are plotted as index numbers to give a comparison between stocks and runs. If you deduct 100 from numbers on the left scale, points on lines read per cent change from 1935-40 averages.

Days' supply of crude for right chart represent average crude stocks for the year divided by daily average crude runs at refineries.

# Crude stocks don't have to match runs

BY JOHN C. CASPER

REFINERS set a new record for refinery runs last year, but crude stocks reached a peak back in 1929. Crude inventories have changed very little over the past 25 years, but crude runs at refineries have gained steadily.

There was a general decline in crude stocks from the 1929 peak until the end of World War II, followed by a gradual rise through 1953.

Lines on the left chart show index numbers of refinery runs and crude stocks for Districts 1-4. Runs for the past 5 years have averaged better than 2½ times the rate for the 1935-40 period. Note that the growth was gradual and reasonably regular from 1935 through 1956. There seems to have been some leveling off for the past 4 years.

For crude stocks in Districts 1-4, the index line of 100 represents 258,700,000 bbl. That total was the average for Districts 1-4 in the 1935-40 period. The low point on the line was for 1945 or the end of World War II. The average for 1960 was 215,600,000 bbl.

Refinery runs for Districts 1-4 averaged 2,620,500 bbl. daily during the base period. Input topped 3,000,000 bbl. daily in 1941 and 4,000,000 bbl. daily in 1947. The average was up to 6,000,000 bbl. daily by 1955 and may top 7,000,000 bbl. daily this year.

The end result of increased refinery runs with no increase in crude stocks shows up in the downward trend of the line in the right chart. This line represents days' supply of crude in Districts 1-4, based on runs.

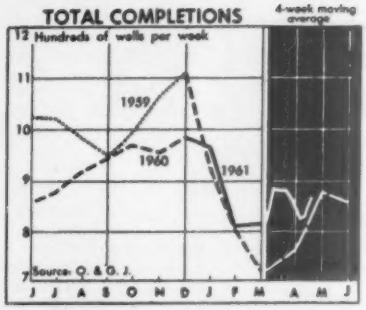
The shape of the curve points to a leveling off at about 25-30 days' supply. Assuming an asymptote at 27 days' supply, runs for Districts 1-4 could climb to 8,000,000 bbl. daily with a crude-stock level of 216,000,000 bbl.

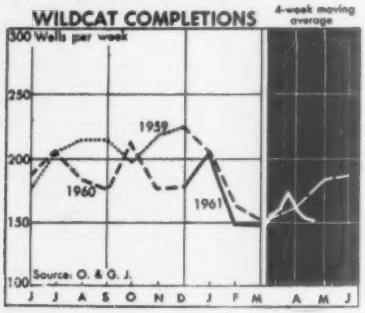
For the country as a whole, stocks of 250,000,000 bbl. would support a refinery input rate of 9,500,000 bbl. daily. The current crude-stock level is 253,940,000 bbl.

## A quick look at the highlights . . .

| | LATEST WEEK | Change from WEEK AGO | | Change from YEAR AGO | |
|---|---|---|---|---|---|
| Production | 7,077,410 | UP | 54,485 | UP | 185,294 |
| Crude stocks | 253,940,000 | UP | 1,760,000 | DOWN | 5,888,000 |
| Completions | 1,005 | UP | 174 | UP | 138 |
| Refinery runs | 7,893,000 | DOWN | 13,000 | DOWN | 42,000 |
| Gasoline stocks | 213,692,000 | DOWN | 2,874,000 | DOWN | 436,000 |
| Kerosine stocks | 27,249,000 | UP | 159,000 | UP | 4,327,000 |
| Distillate stocks | 86,867,000 | UP | 1,337,000 | DOWN | 1,105,000 |
| Residual stocks | 43,390,000 | UP | 36,000 | UP | 4,515,000 |
| Four-product stocks | 371,198,000 | DOWN | 1,342,000 | UP | 7,301,000 |
| Total imports | 1,836,100 | UP | 222,500 | UP | 113,500 |

# Active Rotary Rigs



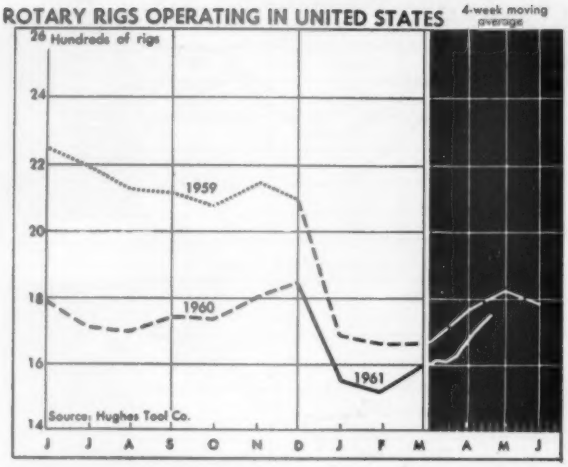

| | 5-22-61 | 5-15-61 | 5-23-60 |
|---|---|---|---|
| Alabama | 7 | 6 | 5 |
| Alaska | 9 | 9 | 5 |
| Arkansas | 9 | 11 | 11 |
| Arizona | 1 | 0 | 2 |
| California | 81 | 87 | 100 |
| Land | 75 | 81 | 94 |
| Offshore | 6 | 6 | 6 |
| Colorado | 25 | 20 | 28 |
| Florida | 0 | 0 | 1 |
| Land | 0 | 0 | 1 |
| Offshore | 0 | 0 | 0 |
| Georgia | 2 | 2 | 0 |
| Illinois | 29 | 31 | 52 |
| Indiana | 5 | 7 | 8 |
| Kansas | 116 | 92 | 138 |
| Kentucky | 2 | 4 | 5 |
| Louisiana | 286 | 274 | 288 |
| North | 28 | 34 | 41 |
| S. Inland waters | 115 | 107 | 113 |
| S. Land | 82 | 80 | 80 |
| Offshore | 61 | 53 | 54 |
| Michigan | 29 | 25 | 42 |
| Mississippi | 59 | 53 | 64 |
| Missouri | 1 | 1 | 3 |
| Montana | 28 | 23 | 20 |
| Nebraska | 37 | 32 | 24 |
| New Mexico | 116 | 106 | 119 |
| New York | 0 | 0 | 1 |
| North Dakota | 20 | 15 | 20 |
| Ohio | 7 | 7 | 5 |
| Oklahoma | 198 | 194 | 193 |
| Oregon | 0 | 0 | 1 |
| Pennsylvania | 6 | 6 | 10 |
| South Dakota | 1 | 1 | 1 |
| Texas | 654 | 652 | 655 |
| S. Inland waters | 8 | 9 | 7 |
| S. Land | 172 | 176 | 177 |
| Offshore | 2 | 2 | 1 |
| North | 66 | 65 | 44 |
| Panhandle | 57 | 55 | 52 |
| East | 82 | 84 | 62 |
| West Central | 165 | 160 | 199 |
| West | 102 | 101 | 113 |
| Utah | 28 | 31 | 31 |
| Virginia | 1 | 0 | 0 |
| Washington | 1 | 1 | 0 |
| West Virginia | 6 | 7 | 4 |
| Wyoming | 39 | 43 | 59 |
| Total U. S. | 1,803 | 1,740 | 1,895 |
| Cum. avg. to date | 1,615 | 1,605 | 1,727 |
| Western Canada | 81 | 80 | 129 |
| Eastern Canada | 0 | 0 | 2 |
| Grand total | 1,884 | 1,820 | 2,026 |

Hughes Tool Co. report.

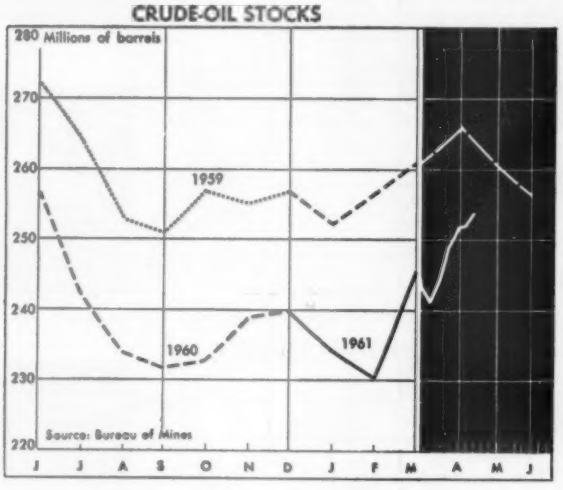
## WEEKLY WELL COMPLETIONS . . . WEEK ENDED MAY 20, 1961

| | Total wells | | | | | | | Cum. | | Total wildcats | | | | | Cum. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | Crude | Cond. | Gas | Dry | Service | Footage | 1961 | 1960 | Total | Crude | Cond. | Gas | Dry | 1961 | 1960 |
| Alabama | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 20 | 0 | 0 | 0 | 0 | 0 | 5 | 1 |
| Alaska | 1 | 1 | 0 | 0 | 0 | 0 | 11,142 | 15 | ..... | 0 | 0 | 0 | 0 | 0 | 2 | ..... |
| Appalachian | 67 | 12 | 0 | 32 | 11 | 12 | 199,445 | 822 | 666 | 7 | 0 | 0 | 2 | 5 | 26 | 17 |
| Arizona | 1 | 0 | 0 | 0 | 1 | 0 | 858 | 9 | 6 | 0 | 0 | 0 | 0 | 0 | 6 | 6 |
| Arkansas | 11 | 4 | 0 | 1 | 6 | 0 | 36,384 | 210 | 239 | 3 | 0 | 0 | 0 | 3 | 38 | 60 |
| California | 34 | 22 | 0 | 1 | 9 | 2 | 130,297 | 653 | 508 | 7 | 0 | 0 | 1 | 6 | 105 | 113 |
| Colorado | 10 | 1 | 0 | 2 | 7 | 0 | 52,884 | 256 | 258 | 5 | 0 | 0 | 0 | 5 | 123 | 123 |
| Illinois | 18 | 7 | 0 | 0 | 11 | 0 | 36,899 | 656 | 733 | 9 | 1 | 0 | 0 | 8 | 133 | 183 |
| Indiana | 16 | 3 | 0 | 0 | 13 | 0 | 25,711 | 228 | 346 | 6 | 1 | 0 | 0 | 5 | 69 | 139 |
| Kansas | 84 | 36 | 0 | 17 | 24 | 7 | 225,867 | 2,029 | 1,230 | 12 | 0 | 0 | 3 | 9 | 372 | 401 |
| Kentucky | 10 | 1 | 0 | 0 | 9 | 0 | 11,136 | 556 | 631 | 1 | 0 | 0 | 0 | 1 | 62 | 75 |
| Louisiana | 61 | 23 | 6 | 6 | 26 | 0 | 399,800 | 1,381 | 1,274 | 9 | 0 | 2 | 0 | 7 | 208 | 184 |
| North | 35 | 15 | 4 | 6 | 10 | 0 | 131,066 | 472 | 404 | 6 | 0 | 2 | 0 | 4 | 79 | 76 |
| South | 21 | 7 | 1 | 0 | 13 | 0 | 204,964 | 696 | 656 | 3 | 0 | 0 | 0 | 3 | 112 | 95 |
| Offshore | 5 | 1 | 1 | 0 | 3 | 0 | 63,770 | 213 | 214 | 0 | 0 | 0 | 0 | 0 | 17 | 13 |
| Michigan | 15 | 5 | 0 | 0 | 9 | 1 | 52,944 | 257 | 282 | 4 | 0 | 0 | 0 | 4 | 102 | 87 |
| Mississippi | 9 | 6 | 0 | 0 | 3 | 0 | 101,140 | 210 | 288 | 2 | 0 | 0 | 0 | 2 | 67 | 91 |
| Montana | 8 | 2 | 0 | 0 | 6 | 0 | 45,085 | 146 | 92 | 4 | 0 | 0 | 0 | 4 | 66 | 40 |
| Nebraska | 23 | 7 | 0 | 0 | 16 | 0 | 102,724 | 354 | 307 | 11 | 0 | 0 | 0 | 11 | 150 | 119 |
| New Mexico | 36 | 19 | 0 | 5 | 12 | 0 | 178,912 | 670 | 695 | 6 | 0 | 0 | 0 | 6 | 122 | 99 |
| West | 20 | 7 | 0 | 5 | 8 | 0 | 87,788 | 272 | 230 | 4 | 0 | 0 | 0 | 4 | 41 | 21 |
| East | 16 | 12 | 0 | 0 | 4 | 0 | 91,124 | 398 | 465 | 2 | 0 | 0 | 0 | 2 | 81 | 78 |
| North Dakota | 9 | 4 | 0 | 0 | 5 | 0 | 64,177 | 95 | 119 | 3 | 0 | 0 | 0 | 3 | 27 | 24 |
| Ohio | 17 | 7 | 0 | 0 | 2 | 8 | 54,988 | 392 | 410 | 0 | 0 | 0 | 0 | 0 | 18 | 21 |
| Oklahoma | 253 | 92 | 4 | 19 | 56 | 82 | 786,239 | 2,369 | 1,481 | 30 | 3 | 0 | 7 | 20 | 247 | 284 |
| Texas | 299 | 146 | 11 | 27 | 107 | 8 | 1,214,810 | 5,455 | 6,220 | 59 | 5 | 1 | 3 | 50 | 1,109 | 1,248 |
| Dist. 1 | 18 | 9 | 0 | 0 | 9 | 0 | 54,347 | 338 | 437 | 8 | 0 | 0 | 0 | 8 | 116 | 147 |
| Dist. 2 | 18 | 5 | 1 | 3 | 9 | 0 | 89,186 | 268 | 284 | 5 | 0 | 0 | 1 | 4 | 58 | 68 |
| Dist. 3 | 41 | 15 | 2 | 3 | 21 | 0 | 251,658 | 416 | 482 | 8 | 0 | 1 | 1 | 6 | 85 | 90 |
| Dist. 4 | 30 | 10 | 2 | 4 | 14 | 0 | 138,561 | 457 | 452 | 8 | 2 | 0 | 0 | 6 | 105 | 127 |
| East | 27 | 12 | 3 | 1 | 11 | 0 | 126,073 | 446 | 471 | 9 | 0 | 0 | 0 | 9 | 101 | 95 |
| Dist. 7-B | 37 | 20 | 2 | 0 | 14 | 1 | 102,930 | 780 | 907 | 9 | 2 | 0 | 0 | 7 | 209 | 254 |
| West | 58 | 37 | 1 | 2 | 14 | 4 | 272,234 | 1,352 | 1,642 | 10 | 0 | 0 | 0 | 10 | 293 | 275 |
| Dist. 9 | 50 | 32 | 0 | 0 | 15 | 3 | 92,917 | 904 | 1,157 | 1 | 1 | 0 | 0 | 0 | 101 | 165 |
| Dist. 10 | 20 | 6 | 0 | 14 | 0 | 0 | 86,904 | 494 | 388 | 1 | 0 | 0 | 1 | 0 | 41 | 27 |
| Utah | 4 | 2 | 0 | 0 | 2 | 0 | 29,288 | 103 | 114 | 2 | 0 | 0 | 0 | 2 | 42 | 41 |
| Wyoming | 18 | 6 | 1 | 1 | 10 | 0 | 100,284 | 378 | 372 | 8 | 1 | 1 | 0 | 6 | 138 | 153 |
| Misc. (Nev.) | 1 | 0 | 0 | 0 | 1 | 0 | 2,681 | 87 | 56 | 1 | 0 | 0 | 0 | 1 | 80 | 45 |
| Total U. S. | 1,005 | 406 | 22 | 111 | 346 | 120 | 3,863,695 | 17,356 | 16,347 | 189 | 11 | 4 | 16 | 158 | 3,317 | 3,554 |
| Previous week | 831 | 361 | 35 | 82 | 258 | 95 | 3,532,357 | ..... | ..... | 143 | 11 | 3 | 5 | 124 | ..... | ..... |
| Cum. 1961 | 17,356 | 7,898 | 383 | 1,695 | 6,189 | 1,191 | 70,387,520 | ..... | ..... | 3,317 | 261 | 43 | 162 | 2,851 | ..... | ..... |
| Cum. 1960 | 16,347 | 7,697 | 523 | 1,344 | 6,314 | 469 | 71,786,452 | ..... | ..... | 3,554 | 325 | 39 | 116 | 3,074 | ..... | ..... |
| Western Canada | 14 | 9 | 0 | 1 | 4 | 0 | 72,727 | 859 | 856 | 5 | 2 | 0 | 0 | 3 | 256 | 259 |

## ROTARY RIGS OPERATING IN UNITED STATES




## CRUDE-OIL STOCKS




## CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

| | 5-13-61 | 5-6-61 | 5-14-60 |
|---|---|---|---|
| Pennsylvania | 2,288 | 2,245 | 2,171 |
| Other Appalachian | 1,440 | 1,378 | 1,632 |
| Illinois, Indiana, Michigan | 9,797 | 9,497 | 9,774 |
| Nebraska and North Dakota | 2,955 | 2,891 | 2,850 |
| Kansas | 9,510 | 9,407 | 10,207 |
| Oklahoma | 17,233 | 17,294 | 17,607 |
| Arkansas | 2,189 | 1,991 | 2,089 |
| Louisiana | 21,661 | 20,702 | 19,694 |
| North | 3,479 | 3,501 | 3,443 |
| South | 18,182 | 17,201 | 16,251 |
| Mississippi, Alabama, Florida | 2,023 | 2,004 | 2,351 |
| New Mexico | 7,707 | 7,845 | 7,284 |
| Texas | 108,716 | 107,923 | 110,785 |
| East Texas | 8,791 | 9,218 | 9,104 |
| West Texas | 49,802 | 48,532 | 50,720 |
| Texas Gulf | 19,808 | 19,144 | 20,090 |
| Other Texas | 30,315 | 31,029 | 30,871 |
| Wyoming | 18,611 | 18,343 | 18,076 |
| Other Rocky Mountain | 9,463 | 9,736 | 9,458 |
| California | 25,633 | 25,753 | 27,755 |
| Foreign | †14,714 | 15,171 | 18,095 |
| Total | **253,940** | 252,180 | 259,828 |

*Bureau of Mines. †Includes 4,452,000 bbl. in California.

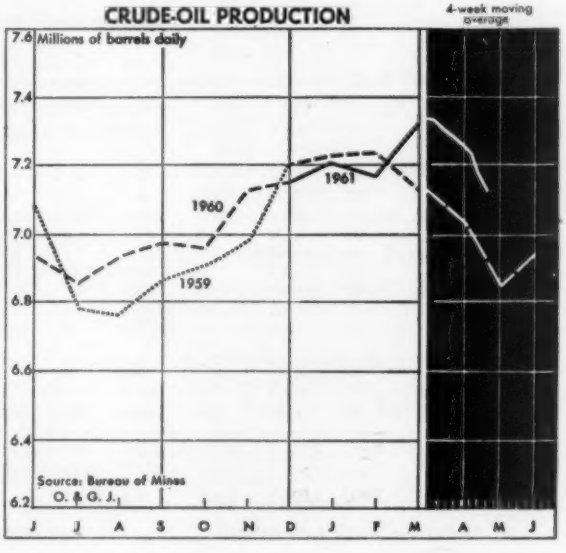
## DAILY AVERAGE PRODUCTION FOR WEEK

| | May 20, 1961 Crude oil | Lease condensate | Total | May 13 total |
|---|---|---|---|---|
| Alabama | 19,300 | ..... | 19,300 | 19,325 |
| Alaska | 13,000 | ..... | 13,000 | 12,600 |
| Arkansas | 80,805 | 120 | 80,925 | 82,800 |
| California | 826,500 | ..... | 826,500 | 826,000 |
| Colorado | 131,800 | ..... | 131,800 | 132,400 |
| Eastern | 40,300 | ..... | 40,300 | 41,200 |
| Florida | 1,100 | ..... | 1,100 | 1,100 |
| Illinois | 207,800 | ..... | 207,800 | 215,300 |
| Indiana | 30,000 | ..... | 30,000 | 30,900 |
| Kansas | †309,310 | ..... | †309,310 | †296,450 |
| Kentucky | 49,200 | ..... | 49,200 | 49,200 |
| Louisiana | 1,020,000 | 142,700 | 1,162,700 | 1,162,550 |
| North | 105,000 | 5,200 | 110,200 | 110,050 |
| South | 915,000 | 137,500 | 1,052,500 | 1,052,500 |
| Michigan | 52,700 | ..... | 52,700 | 52,500 |
| Mississippi | 146,000 | 4,200 | 150,200 | 150,175 |
| Montana | 83,000 | ..... | 83,000 | 82,000 |
| Nebraska | 67,000 | ..... | 67,000 | 67,300 |
| Nevada | 450 | ..... | 450 | 450 |
| New Mexico | 310,000 | 7,300 | 317,300 | 317,300 |
| North Dakota | 58,000 | ..... | 58,000 | 61,300 |
| Oklahoma | †538,500 | ..... | †538,500 | †512,400 |
| Texas | 2,355,000 | 93,350 | 2,448,350 | 2,448,350 |
| Dist. 1 | 43,000 | 2,400 | 45,400 | 45,400 |
| Dist. 2 | 97,000 | 8,400 | 105,400 | 105,400 |
| Dist. 3 | 298,000 | 39,000 | 337,000 | 337,000 |
| Dist. 4 | 167,000 | 13,800 | 180,800 | 180,800 |
| Dist. 5 | 26,000 | 600 | 26,600 | 26,600 |
| Dist. 6 | 104,000 | 8,400 | 112,400 | 112,400 |
| East Texas field | 124,000 | ..... | 124,000 | 124,000 |
| Dist. 7-B | 120,000 | 400 | 120,400 | 120,400 |
| Dist. 7-C | 108,500 | 3,150 | 111,650 | 111,650 |
| Dist. 8 | 977,000 | 11,000 | 988,000 | 988,000 |
| Dist. 9 | 190,000 | 3,800 | 193,800 | 193,800 |
| Dist. 10 | 100,500 | 2,400 | 102,900 | 102,900 |
| Utah | 97,600 | ..... | 97,600 | 70,500 |
| Wyoming | 391,700 | ..... | 391,700 | 390,100 |
| Others | ‡675 | ..... | ‡675 | ‡725 |
| Total U. S. | 6,829,740 | 247,670 | **7,077,410** | 7,022,925 |
| Change from prev. week, up | | | **54,485** | ..... |
| Canada | †636,000 | ..... | †636,000 | †615,000 |

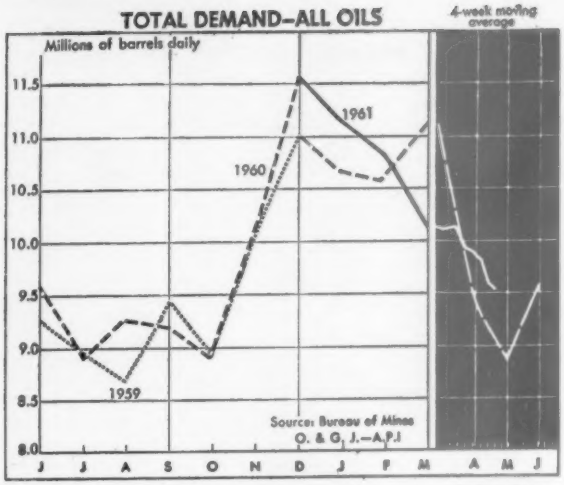
Total U. S. prod.—Jan. 1-May 20 ..... 1,014,740,900 bbl.
Same period last year (crude plus cond.) ..... *1,003,226,800 bbl.

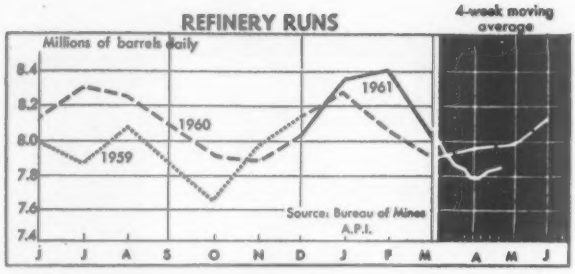
*Includes 32,856,300 bbl. condensate. †Week ended previous Monday. ‡South Dakota and Arizona.

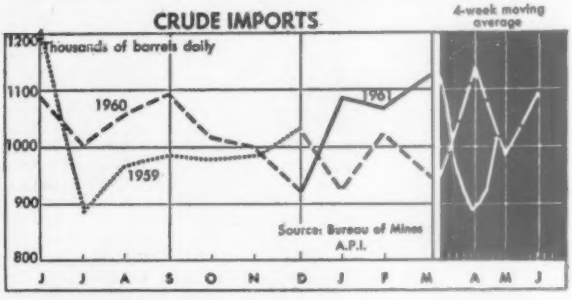
## CRUDE-OIL PRODUCTION

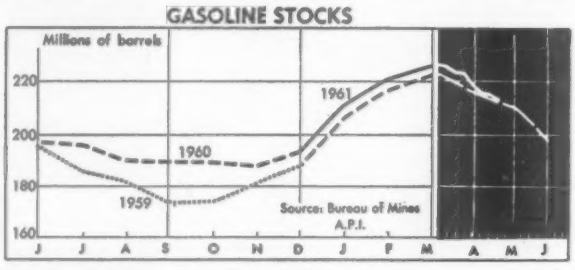


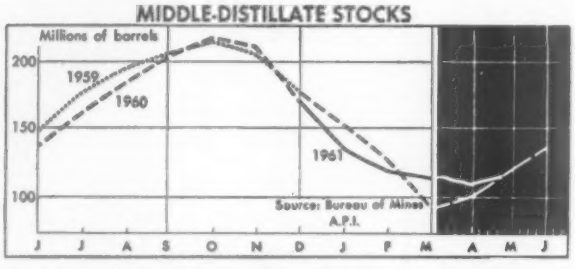
## REFINING

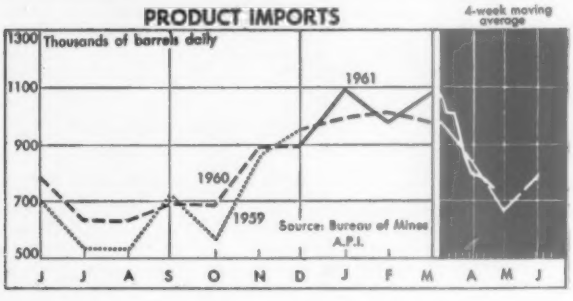


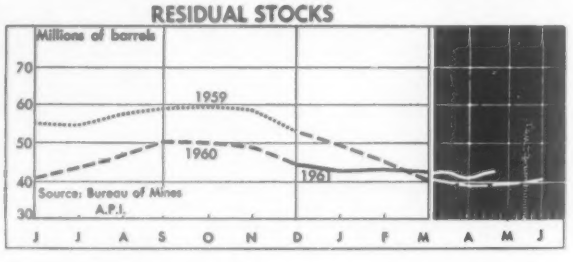




### API REFINERY REPORT, MAY 19, 1961
(Thousands of barrels)

| District— | Daily avg. runs | Daily average production Gaso.* | Kero. | Dist. | Resid. | Stocks‡ Gaso.† | Kero. | Dist. | Resid. | Bureau of Mines, May 1960 Daily avg. runs | Daily average production Gaso.* | Kero. | Dist. | Resid. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East Coast | 1,090 | 499.1 | 10.7 | 325.3 | 141.4 | 49,375 | 10,024 | 25,707 | 10,817 | 1,129 | 490.9 | 31.7 | 317.3 | 149.4 |
| Appalachian: | | | | | | | | | | | | | | |
| District 1 | 99 | 40.0 | 3.6 | 22.0 | 8.3 | 6,146 | 671 | 1,837 | 399 | 97 | 39.0 | 3.6 | 21.4 | 7.6 |
| District 2 | 101 | 53.9 | 2.6 | 18.3 | 12.7 | 3,055 | 398 | 964 | 332 | 74 | 43.9 | 1.1 | 15.4 | 5.7 |
| Ind., Ill., Ky. | 1,270 | 689.3 | 67.7 | 238.6 | 142.3 | 39,626 | 4,702 | 14,824 | 5,199 | 1,424 | 734.4 | 66.9 | 283.7 | 136.3 |
| Minn., Wis., Dak. | 93 | 36.9 | 0.7 | 15.3 | 209. | 6,482 | 523 | 3,498 | 616 | 120 | 57.9 | 4.4 | 29.7 | 15.8 |
| Okla., Kans., Mo. | 703 | 414.0 | 8.4 | 153.1 | 22.6 | 18,700 | 1,297 | 9,032 | 965 | 692 | 381.8 | 16.6 | 157.2 | 20.7 |
| Inland Texas | 300 | 210.3 | 7.0 | 50.7 | 19.1 | 8,112 | 515 | 1,410 | 2,615 | 291 | 213.1 | 8.0 | 48.5 | 18.5 |
| Texas Gulf Coast | 1,907 | 954.7 | 80.1 | 387.7 | 140.1 | 30,704 | 3,366 | 9,697 | 5,005 | 1,890 | 952.8 | 101.5 | 426.5 | 128.2 |
| La. Gulf Coast | 663 | 399.0 | 19.6 | 183.1 | 48.0 | 10,993 | 3,054 | 4,296 | 1,036 | 680 | 348.4 | 41.2 | 158.3 | 41.8 |
| N. La. and Ark. | 119 | 74.4 | 3.4 | 27.6 | 5.4 | 5,849 | 561 | 1,637 | 118 | 110 | 65.0 | 5.8 | 22.9 | 4.4 |
| Rocky Mountain: | | | | | | | | | | | | | | |
| New Mexico | 23 | 11.7 | 0.7 | 4.8 | 2.1 | 724 | 49 | 200 | 47 | 24 | 11.8 | 0.5 | 4.1 | 2.6 |
| Other Rocky Mt. | 295 | 141.7 | 1.4 | 63.3 | 37.6 | 7,602 | 425 | 2,236 | 914 | 244 | 118.0 | 2.1 | 60.0 | 30.0 |
| West Coast | 1,230 | 586.9 | 36.0 | 180.9 | 297.1 | 26,324 | 1,664 | 11,529 | 15,327 | 1,188 | 532.0 | 34.4 | 191.8 | 280.0 |
| May 19, 1961 | 7,893 | 4,111.9 | 241.9 | 1,670.7 | 897.6 | 213,692 | 27,249 | 86,867 | 43,390 | 7,963 | 3,989.0 | 317.8 | 1,736.8 | 841.0 |
| May 12, 1961 | 7,906 | 4,053.7 | 308.3 | 1,665.3 | 867.9 | §216,566 | 27,090 | 85,530 | 43,354 | ..... | ..... | ..... | ..... | ..... |
| May 20, 1960 | 7,935 | 3,894.6 | 316.9 | 1,728.1 | 884.0 | 214,128 | 22,922 | 87,972 | 38,875 | ..... | ..... | ..... | ..... | ..... |

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines. §Revised.

## CRUDE-OIL PRICES

GRAVITY SCHEDULE

| | Signal Hill, Calif. | Oklahoma | West Tex. (sour) | West Tex. (Inter.) | No.* Texas | Texas Refugio Light | Bayou Sale (La.) | Denver Julesburg | Wyo. (sour) |
|---|---|---|---|---|---|---|---|---|---|
| 14-14.9 | $1.86 | .... | .... | .... | .... | .... | .... | .... | .... |
| 15-15.9 | 1.93 | .... | .... | .... | .... | .... | .... | .... | $1.81 |
| 16-16.9 | 2.00 | .... | .... | .... | .... | .... | .... | .... | 1.86 |
| 17-17.9 | 2.06 | .... | .... | .... | .... | .... | .... | .... | 1.91 |
| 18-18.9 | 2.13 | .... | .... | .... | .... | .... | .... | .... | 1.96 |
| 19-19.9 | 2.20 | .... | (†) | .... | .... | .... | .... | .... | 2.01 |
| 20-20.9 | 2.27 | $2.49 | $2.35 | $2.61 | $2.29 | $2.95 | $2.90 | $2.58 | 2.06 |
| 21-21.9 | 2.33 | 2.52 | 2.38 | 2.63 | 2.33 | 2.97 | 2.92 | 2.60 | 2.11 |
| 22-22.9 | 2.40 | 2.55 | 2.41 | 2.65 | 2.37 | 2.99 | 2.94 | 2.62 | 2.16 |
| 23-23.9 | 2.46 | 2.58 | 2.44 | 2.67 | 2.41 | 3.01 | 2.96 | 2.64 | 2.21 |
| 24-24.9 | 2.53 | 2.61 | 2.47 | 2.69 | 2.45 | 3.03 | 2.98 | 2.66 | 2.26 |
| 25-25.9 | 2.60 | 2.64 | 2.50 | 2.71 | 2.49 | 3.05 | 3.00 | 2.68 | 2.31 |
| 26-26.9 | 2.67 | 2.67 | 2.53 | 2.73 | 2.53 | 3.07 | 3.02 | 2.70 | 2.36 |
| 27-27.9 | 2.74 | 2.70 | 2.56 | 2.75 | 2.57 | 3.09 | 3.04 | 2.72 | 2.49 |
| 28-28.9 | 2.81 | 2.73 | 2.59 | 2.77 | 2.61 | 3.11 | 3.06 | 2.74 | 2.54 |
| 29-29.9 | 2.87 | 2.76 | 2.62 | 2.79 | 2.65 | 3.13 | 3.08 | 2.76 | 2.59 |
| 30-30.9 | 2.93 | 2.79 | 2.65 | 2.81 | 2.69 | 3.15 | 3.10 | 2.78 | 2.63 |
| 31-31.9 | 3.00 | 2.82 | 2.68 | 2.83 | 2.73 | 3.17 | 3.12 | 2.80 | 2.67 |
| 32-32.9 | 3.06 | 2.85 | 2.71 | 2.85 | 2.77 | 3.19 | 3.14 | 2.82 | 2.71 |
| 33-33.9 | 3.12 | 2.88 | 2.74 | 2.87 | 2.81 | 3.21 | 3.16 | 2.84 | 2.75 |
| 34-34.9 | 3.17 | 2.91 | 2.77 | 2.89 | 2.85 | 3.23 | 3.18 | 2.86 | 2.79 |
| 35-35.9 | 3.22 | 2.94 | 2.80 | 2.91 | 2.89 | 3.25 | 3.20 | 2.88 | 2.83 |
| 36-36.9 | 3.27 | 2.97 | 2.83 | 2.93 | 2.93 | 3.27 | 3.22 | 2.90 | 2.87 |
| 37-37.9 | 3.31 | 2.99 | 2.86 | 2.95 | 2.95 | 3.29 | 3.24 | 2.92 | 2.89 |
| 38-38.9 | .... | 3.01 | 2.89 | 2.97 | 2.97 | 3.31 | 3.26 | 2.94 | 2.91 |
| 39-39.9 | .... | 3.03 | 2.92 | 2.99 | 2.99 | 3.33 | 3.28 | 2.96 | 2.93 |
| 40-44.9 | .... | 3.05 | 2.95 | 3.01 | 3.01 | 3.35 | 3.30 | 2.98 | 2.95 |

*Cooke, Grayson, Montague. †Two buyers announced increase.

### FLAT PRICES

| | |
|---|---|
| **Louisiana:** | |
| Sweet Lake | $3.00 |
| **Texas:** | |
| East Texas | 3.05-3.25 |
| Conroe | 3.23-3.53 |
| Van | 3.08 |
| **Pennsylvania Grade:** | |
| Bradford | $4.80 |
| Middle District | 4.52 |
| Southwest Pennsylvania | 4.25 |
| West Virginia | 4.17 |
| Buckeye Grade | 4.08 |
| **Illinois Basin** | **3.00-3.05** |

### FOREIGN

| | |
|---|---|
| **Middle East, Persian Gulf: (cargoes f.o.b. lifting port)** | |
| Arabian, 34.0°-34.9°, Ras Tanura | $1.80 |
| Iranian, 34.0°-34.9°, Bandar Mashur | 1.78 |
| Iranian, 34.0°-34.9°, Abadan | 1.73 |
| Iraq, 35.0°-35.9°, Fao | 1.72 |
| Kuwait, 31.0°-31.9°, Mina-al-Ahmadi | 1.59 |
| Qatar, 41.0°-41.9°, Umm said | 1.95 |
| **Middle East, E. Mediterranean:** | |
| Arabian, 34.0°-34.9°, Sidon | $2.17 |
| Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli | 2.19 |
| **Far East (cargoes, f.o.b. Lutong, Sarawak):** | |
| Seria Light, 36° | 2.42 |
| **Canada:** | |
| Leduc-Woodbend | $2.53 |
| Redwater (Alta.) | 2.42 |
| Weyburn (light) | 2.06 |
| Midale C | 1.70 |
| **Venezuela:** | |
| Cumarebo, 47°-47.9°, Tucupido | 3.34 |
| San Joaquin, 40°-40.9°, Puerto La Cruz | 3.08 |
| Oficina, 35°-35.9°, Puerto La Cruz | 2.80 |
| Tia Juana medium, 26°-26.9°, Amuay* | 2.30 |
| Quiriquire, 16.0°-16.4°, Caripito | 2.10 |
| Lagunillas heavy, flat, Las Piedras* | 2.10 |
| Bachaquero, flat, 15°-16°, Las Piedras* | 1.88 |

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

### TANKER RATES (Long Ton)

(Latest reported spot fixtures)

| | |
|---|---|
| Gulf-NY, dirty (ATRS—7.5%) | $2.64 |
| Carib.-NY, clean (ATRS—65%) | 0.96 |
| Carib.-NY, dirty (ATRS—60%) | 1.10 |
| PG-UK dirty (Scale—68%) (21s. 7d.) | 3.02 |
| PG-NY, dirty (USMC—72.5%) | 3.49 |

★Denotes change from previous week.

## REFINED PRODUCTS

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

### GASOLINE*

| | |
|---|---|
| **Mid-Continent (Group 3):** | |
| ★ Regular (91 octane) | 11.25-11.50 |
| ★ Premium (99 octane) | 14.00-14.25 |
| Natural gasoline (26-70) | 4.5 |
| Breckenridge | 4.0 |
| **Gulf Coast (cargoes for coastwise or export movements):** | |
| Regular (90 octane) | 10.50-11.00 |
| Regular (92 octane) | 10.75-11.25 |
| Premium (98 octane) | 11.75-12.25 |
| **California (rack) Los Angeles:** | |
| ★ Regular (90 octane) | 11.60 |
| ★ Premium (94 octane) | 12.60 |
| ★ Premium (100 octane) | 14.10 |
| **Caribbean area (cargoes):** | |
| Regular (87 octane) | 9.125 |
| Premium (97 octane) | 11.50 |

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

### KEROSINE AND DISTILLATE

| | |
|---|---|
| **Mid-Continent (Group 3):** | |
| ★ Kerosine 42-44 | 9.50-10.00 |
| ★ Diesel oil (58 d.i. and above) | 9.25-9.50 |
| ★ Distillate No. 1 | 9.25-9.50 |
| ★ Distillate No. 2 | 8.25-8.50 |
| **Gulf Coast (cargoes):** | |
| Kerosine 41-43 | 9.25-9.50 |
| Distillate No. 2 | 8.25-8.75 |
| **New York Harbor (barges):** | |
| Kerosine 42-43 | *11.40 |
| Distillate No. 2 | *10.40 |
| Diesel fuel, 48-52 d.i. | *10.55 |
| **Caribbean area (cargoes):** | |
| Distillate No. 2 | 8.625 |

*Subject to 0.5 cent discount.

### RESIDUAL FUEL (Bbl.)

| | |
|---|---|
| **Mid-Continent (Group 3):** | |
| ★ Residual fuel (max. 1% S) | $1.65-1.75 |
| **Gulf Coast (cargoes):** | |
| ★ Bunker C fuel | 2.10-2.20 |
| **New York Harbor (barges):** | |
| Bunker C fuel | 2.52 |
| **Caribbean (cargoes):** | |
| Bunker C fuel | 2.00 |
| **California (rack):** | |
| Bunker C fuel, Los Angeles | 2.25 |

# Classified Advertising

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RATES:

- UNDISPLAYED CLASSIFIED: 30c a word per issue. 10% discount for three or more consecutive issues. $5.00 minimum charge. Blind box in our care count nine extra words. Not subject agency commission.
- DISPLAYED CLASSIFIED: $20 a column inch one issue. 10% discount three or more consecutive issues. Minimum size one inch. Subject to agency commission.
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- DEADLINE: Copy to reach The Oil and Gas Journal not later that 9 a.m. on Wednesday preceding date of publication. **Send advertisments to:** Classified Advertising Manager, THE OIL AND GAS JOURNAL, P. O. Box 1260, Tulsa 1, Oklahoma.

**EXCEPT . . .**

WESTERN STATES: (California, Washington, Oregon, Idaho, Nevada, Utah, and Arizona). Write: Classified Departments, Inc., The Oil and Gas Journal, 4041 Marlton Ave., Los Angeles 8, Calif. Phone AXminister 2-0287. Copy deadline Monday noon.

## FOR SALE EQUIPMENT

MISC. DRILLING equipment, Unit drawworks, Lee C. Moore masts, light plants, standby pumps, drill collars, drill pipe, line pipe, water tanks, tongs, swivels, rotary tables, tool houses, for rent or sale. 906-914 S.E. 29th, OR 7-4541, Oklahoma City.

### FOR SALE
### GASOLINE PLANT EQUIPMENT
**Bishop, Texas**

Absorbers—1250# to 2100# w.p.
Towers—150# to 2000# w.p.

**VESSELS, PRESSURE TANKS, REBOILERS, ELECTRIC MOTOR-DRIVEN CENTRIFUGAL AND RECIPROCATING PUMPS—ATMOSPHERIC COOLERS—HEAT EXCHANGERS—COMPRESSOR CYLINDERS—BOILERS—METERS—REGULATORS—MISCELLANEOUS TANKS INCLUDING 10,000-BBL. FLOATING ROOF.**

All Material Excellent Condition
Complete Inventory Available on Request

**Mid-States Pipe and Supply Co.**
P. O. Box 2534 Phone LUther 2-9128
Tulsa, Oklahoma

### FOR SALE

14—G-R, Atmospheric Cooling Sections, Type 2-153-240, Model GRX-S, single pass, 900 psig WP.
6—Coynco (NEW) Fin Tube Sections, 2 pass Jacket Water Coolers, 446 sq. ft. each.
Compressor Cylinders for Clark Bros., Cooper-Bessemer and Ingersoll-Rand Gas Engine Compressors.

**Write or call:**
**C. J. SMITH**
**Oil Capital Building, Tulsa, Oklahoma**
**Phone: LUther 2-5516**

### LOCATED HOUSTON, TEXAS
**(from Amoco Refinery Co., Destrehan, La.)**

**HEAT EXCHANGERS**
50 to 4,000 sq. ft.
**VESSELS—TOWERS**
12" to 8' dia.
**PETROCHEM FURNACES**
½MM, 2½MM, 5MM BTU
**PUMPS**
50 to 7,000 GPM

*—WIRE—PHONE—WRITE—*

**BRILL EQUIPMENT COMPANY**
4101 SAN JACINTO ST., HOUSTON 4, TEXAS
35-45 JABEZ STREET, NEWARK 5, N. J.

## FOR SALE EQUIPMENT

AN INVESTMENT! Productive advertising is an investment rather than an expenditure. Experienced oil men have found that The Oil and Gas Journal is their best classified advertising medium.

### FOR SALE

1—7¼" x 12" Gardner Denver Pump w/ Cummins Diesel Engine
1—D-300 Emsco Power Pump
1—131' Lee C. Moore Jacknife Derrick & Substructure
6600'—4½" EUE Drill Pipe w/18° taper Flash-welded API Ex Tool Joints

Write for Equipment Inventory.
**NOWERY DRILLING COMPANY, INC.**
5904 Fairfield Avenue, Shreveport, Louisiana

## FOR SALE EQUIPMENT

83-72-71 SPEEDSTARS and several Bucyrus cable tool rigs. Also 2—1000 Mayhew and other Rotaries. We have service and repairs for Star and Keystone Machines. Manufacturers of Rotary and Cable tools. Star Drilling Supply Co., Chanute, Kansas.

### AT N. LITTLE ROCK, ARKANSAS

3—Worthington #LTC-4 compressors, 3500 CFM @ 45 PSI, 24 x 15, 2-cyl., 500 HP, 4-cycle. gas-engine drive.

**Phone POplar 3-3505**

**PERRY EQUIPMENT CORP.**
1402 N. Sixth St.
Philadelphia 22, Pa.

# LIQUIDATION

## ESSO REFINERY—BALTIMORE, MD.—MOST EQUIPMENT NEW 1956

**TOWERS**

84" x 39' 16 Trays 178 PSI
54" x 30' 12 Trays 200 PSI NEW
48" x 39' 16 Trays 283 PSI
36" & 6' x 97' 34 Trays 280 PSI
30" x 36' 9" 7 Trays 360 PSI

**PETRO-CHEM FURNACES**

30.7MM/BTU 19.3MM/BTU
10.4MM/BTU 9.7MM/BTU
7.5MM/BTU 2MM/BTU

**NEW 5% CHROME FURNACE TUBES**

1,200'-6" ½" Wall 420'-6" ⅜" Wall
114'-5" " " 250'-5" " "
1,030'-4" " " 1,300'-4" " "

**DRUMS**

12' x 45' 171 PSI NEW
10' x 30' 160 PSI Lead Lined
9' 4" x 38' 345 PSI Refractory
8' 6" x 35' 120 PSI Gunite
94" x 20' 319 PSI Refractory
6' x 33' 175 PSI Gunite
6' x 27' 300 PSI 18-8 SS Screens
6' x 13' 114 PSI NEW
64" x 25' 323 PSI Refractory
5' x 20' 240 PSI NEW
4' x 17' 530 PSI
4' x 14' 250 PSI Gunite
3' x 16' 286 PSI
3' x 13' 300 PSI Gunite
3' x 12' 5" 550 PSI

**COMPRESSORS**

3—Ingersoll-Rand 510 CFM Hydrogen Recycle Type 2HHE Non-Lubricated Compressors, Single Stage, Double Acting, 2 Cylinder, 500 PSI Discharge, 350 HP Totally Enclosed Inert Gas Filled Motor Drive.
2—Worthington Recycle Gas Boosters 7¾" x 9", Motor Drive.

**HEAT EXCHANGERS & CONDENSERS**

| 18-8 STAINLESS STEEL | | | ADMIRALTY | | | 5% CHROME | | |
|---|---|---|---|---|---|---|---|---|
| SqFt | Tubes | Shell | SqFt | Tubes | Shell | SqFt | Tubes | Shell |
| 2,320 | 75 PSI | 135 PSI | 1,640 | 100 PSI | 145 PSI | 1,040 | 1,500 PSI | 110 PSI NEW |
| 1,860 | 625 PSI | 145 PSI | 1,350 | 100 PSI | 530 PSI | 975 | 530 PSI | 200 PSI |
| 1,150 | 75 PSI | 15 PSI | 1,135 | 100 PSI | 230 PSI | 573 | 530 PSI | 715 PSI |
| 1,000 | 100 PSI | 50 PSI | 1,025 | 75 PSI | 100 PSI NEW | | STEEL | |
| 890 | 100 PSI | 75 PSI | 665 | 100 PSI | 236 PSI | 2,240 | 840 PSI | 260 PSI |
| 615 | 100 PSI | 75 PSI | 600 | 100 PSI | 325 PSI NEW | 1,040 | 840 PSI | 145 PSI |
| 420 | 100 PSI | 100 PSI | 548 | 100 PSI | 200 PSI | 890 | 230 PSI | 165 PSI |
| 235 | 75 PSI | 75 PSI | 216 | 100 PSI | 260 PSI | 485 | 715 PSI | 260 PSI |
| | | | | | | 238 | 570 PSI | 530 PSI |

**RECYCLE GAS DRYER**
consisting of
2—4' 6" x 11' Recycle Drums 600 PIS
1—1' 4" x 4' 3" Hydrier 230 PSI

**CENTRIFUGAL BLOWER**
7,500 CFM, 42.5 PSIG with 1,250 HP
Synchronous motor

**PUMPS**

Ingersoll-Rand 400 GPM @ 615'
Pacific 349 GPM @ 2,040' 7 Stage
Pacific 173 GPM @ 738'
Byron Jackson 107 GPM @ 1,460' 12 Stage 410 SS Impeller
Byron Jackson 88 GPM @ 1,750' 8 Stage

**Heat & Power Co., Inc.**
NEW YORK OFFICE—60 E. 42, N. Y. 17 • MU 7-5280
TULSA OFFICE, 310 Thompson Bldg. Tulsa 3, Okla., LUther 3-4890
SITE OFFICE—Boston & Haven Sts. Baltimore 24, Md., ORleans 5-0595

## FOR SALE EQUIPMENT

WILL SACRIFICE! All offers considered. 800 HP Worthington, LT6 Compressor. Box M-381, The Oil and Gas Journal, Tulsa, Oklahoma.

CORE DRILL SPECIAL—New hydraulic, angle 800' capacity drill. Truck mounted. Ready for service. Bargain price. Pressey and Son. Pueblo, Colorado.

CLARK MA-4 Gas Compressor, 150 HP, skid-mounted with radiator and accessories; 2 I.R. XVG6 Gas Compressors; 4225 HP Clark Centrifugal Compressor 9920 CFM 240 PSI discharge Pumps; Exchangers; Vessels. Brill Equipment Company, 4101 San Jacinto St., Houston 4, Texas.

USED QUICK-CYCLE Hydrocarbon recovery gas dehydration unit 12 MM SCFD capacity at 1,000 psi. W.P.—turnkey installation. Other used gas processing equipment including absorption and fractionation towers, vessels, heat exchangers, furnaces and gas chillers; gas dehydrators—glycol and dry desiccant types. Engineered Specialties Co. Phone FLeetwood 1-5284, Dallas, Texas.

EQUIPMENT USED 30 days, 36 inch stroke Alten Jack #5 with diesel engine, 30 inch stroke Bethelem Jack. Two 100 bbl. tanks and accessories. Miscellaneous pipe, casing, fittings etc. Located Greensburg, Kentucky. Contact Ben Levy, 421 Maritime Bldg., New Orleans, La.

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CASINGHEAD GASOLINE plant foreman needed by independent oil company. Please state qualifications, references. Replies confidential. Box M-415, The Oil and Gas Journal, Tulsa, Oklahoma.

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**Box M-389, The Oil and Gas Journal**
**Tulsa, Oklahoma**

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**Box M-409, The Oil and Gas Journal**
**Tulsa, Oklahoma**

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**Kerr-McGee Building, Oklahoma City, Oklahoma**

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**KERR-McGEE BUILDING**
**Oklahoma City, Oklahoma**

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**Box M-410, The Oil and Gas Journal**
**Tulsa, Oklahoma**

HELP WANTED

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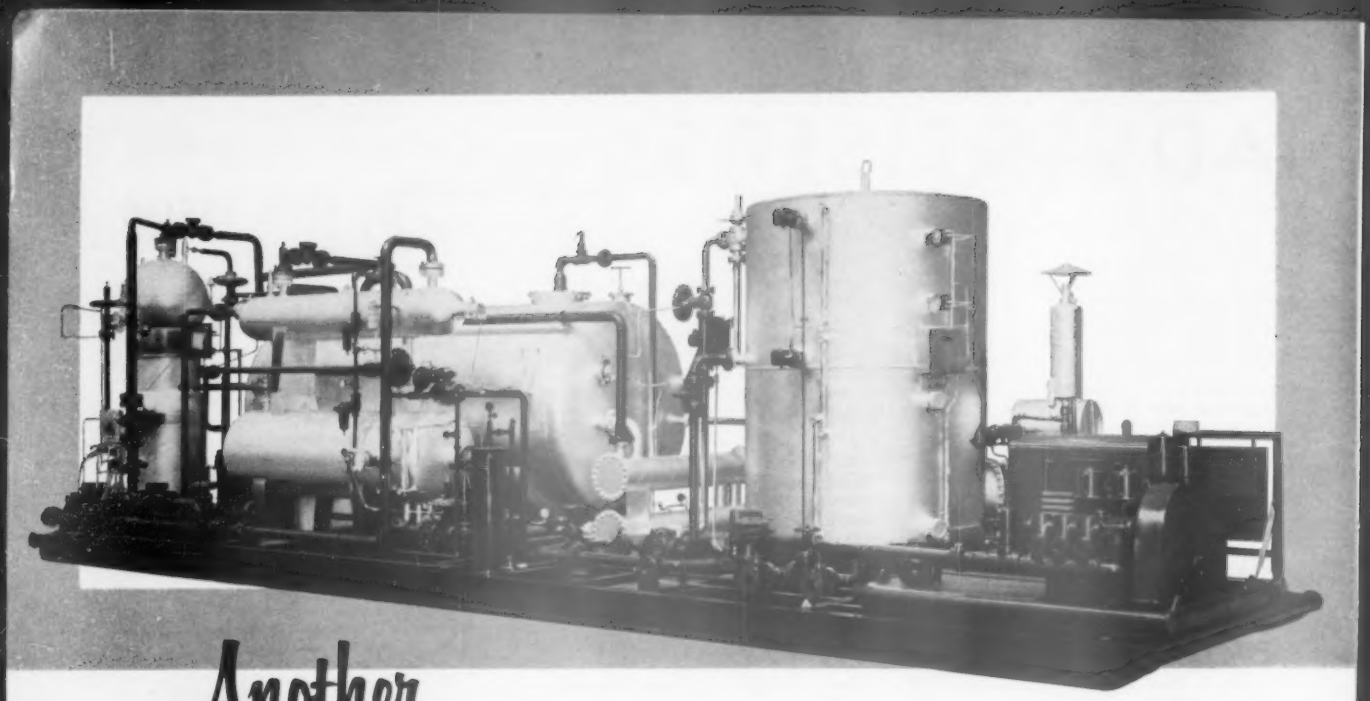

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DRAWER 1710

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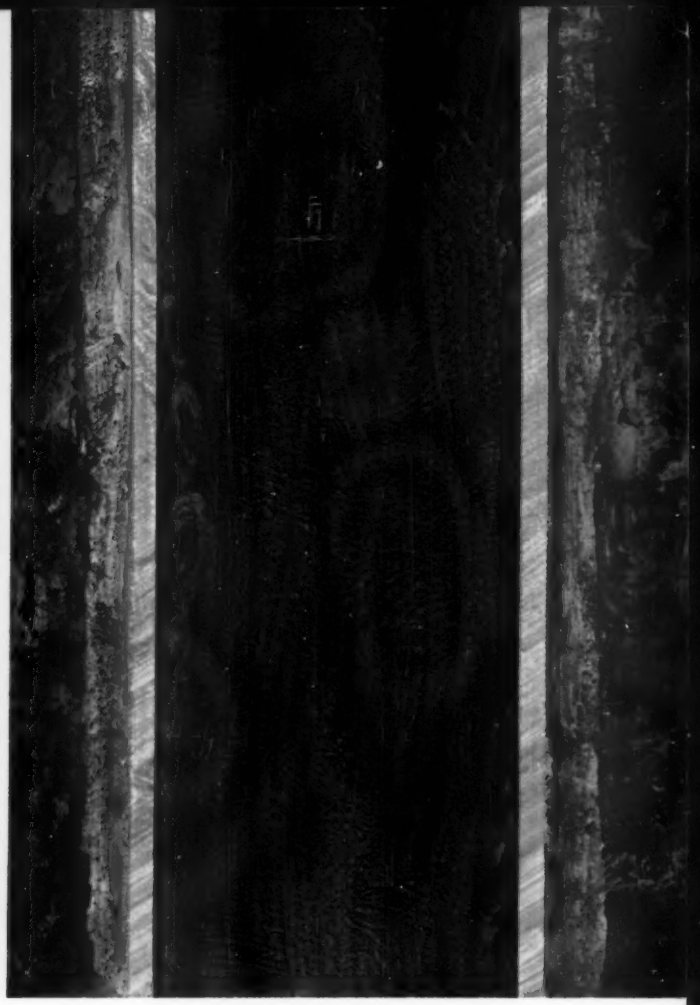

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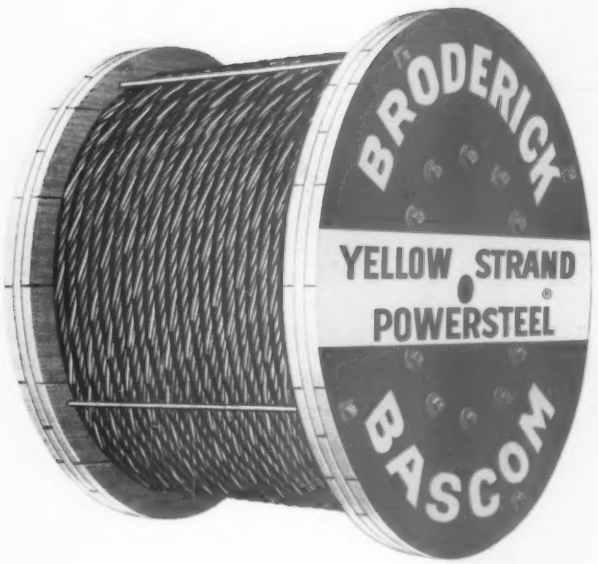


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